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PROPAGATION AND DISTRIBUTION OF FOOD FISHES

FISCAL YEAR 1926

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By GLEN C. LEACH

Appendix VI 1926

DEPARTMENT OF COMMERCE
Bureau of Fisheries Document No. 1011

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DEPARTMENT OF COMMERCE
BUREAU OF FISHERIES
HENRY O'MALLEY, Commissioner

PROPAGATION AND DISTRIBUTION OF FOOD FISHES

FISCAL YEAR 1926

By GLEN C. LEACH
Assistant in Charge, Division of Fish Culture

APPENDIX VI TO THE REPORT OF THE U. S. COMMISSIONER OF FISHERIES FOR 1926

Bureau of Fisheries Document No. 1011

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PROPAGATION AND DISTRIBUTION OF FOOD FISHES, FISCAL YEAR 1926 [1]

By GLEN C. LEACH, *Assistant in Charge, Division of Fish Culture*

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INTRODUCTION

Probably the most popular and educational feature of the fish-cultural work of the Bureau of Fisheries during the past fiscal year was the development and extension of the fish-nursery project that was inaugurated during the last half of the previous fiscal year. This work is being enlarged as rapidly as facilities will permit and at the present time provides not only for the rearing of trout but also for the production of large fingerling black bass, crappie, and bream on a cooperative basis. The most enthusiastic interest in this undertaking thus far shown has been manifested by fishing clubs and similar organizations in the States of Pennsylvania, Wisconsin, and Minnesota.

The output of fingerling fish in 1926 was almost twice that of the preceding year, due to the special efforts made to rear fish at every point where suitable facilities for such work exist. The public demand for fingerling fish is increasing rapidly, and it is doubtful whether there is any way of meeting it except by arranging with various fish and game organizations throughout the country to rear a large proportion of the small fish incubated each year at the Federal hatcheries. Such assistance would not only relieve the crowded condition of these hatcheries during the spring months, but it would enable the bureau to produce larger numbers of small fish than heretofore. The greatest value of the cooperative nursery work, however, doubtless lies in the increasing interest it is bound to incite on the part of the general public in the protection of fish in the open waters. In view of the fact that virtually all of the organizations participating in such cooperation have memberships of from 1,000 to 5,000, the extent of this beneficial influence can readily be realized. Each member of a cooperating association naturally will be interested not only in the success of the work in hand but in the protection of the fish after they are released. Some organizations have decided to prolong the rearing operations, holding the fish for from 15 to 18 months after receiving them from the bureau's hatcheries. If instead of being released as 3-inch or 4-inch fry in the fall of the year, as will be necessary in many instances, the fish can be held and fed until they are 18 months old and planted in October, many of them will have attained their first spawning period and will be of immediate benefit to the streams in which they are placed, while at the opening of the succeeding fishing season they will have reached the legal size for capture.

Thus far the Central Pennsylvania Fish and Game Protective Association has taken the lead in cooperative work. In connection with its nursery project, located at Chapel Hille, Pa., this organization has expended several thousand dollars in the purchase of equipment, and it is now considering the construction of a hatchery capable of handling from 500,000 to 1,000,000 trout eggs. If a hatchery of this size can be established, it will greatly relieve the strain on the Federal hatchery at White Sulphur Springs, W. Va., which at the present time is called upon to produce all fish required for waters in Pennsylvania.

With the view of meeting the greatest need of the bureau, which is for more bass, crappie, and other warm-water pond fishes, the propagation of such species on a large scale at a number of pond locations in various sections of the United States is being considered. If such plans can be carried out, ponds varying in size from 50 to 100 acres will be utilized for the production of fingerling fish, which will be distributed in the fall when 3 or 4 months old. For this purpose the bureau now is cooperating with the State of Florida in establishing bass hatcheries in that State. The Florida authorities are greatly interested in the fishing question because of the large number of visitors to the State during the winter. The tourist season and the spawning period of the bass overlap to a certain extent. It would be a rather delicate undertaking to refuse fishing privileges to tourists, but if fishing be permitted during the bass spawning season it will not be possible long to maintain the supply of bass in Florida waters. In propagating bass the greatest benefit will be derived from the development of public interest in protective measures.

The bureau continues to make annual collections of bass and other warm-water fishes from overflowed lands bordering the Mississippi River. These are distributed principally in waters in the States of Minnesota, Wisconsin, Iowa, and Illinois, only a very small number being sent to more remote points. During the year the station at La Crosse, Wis., made preparations for taking up the production of fish in the territory included in the upper Mississippi wild life and fish refuge. Boats and other movable equipment required for the work were obtained, but as the Government had not purchased any land under the provisions of the act creating this refuge no expenditures could be made for improvements to natural ponds. As soon as the property has been acquired the bureau will take steps to utilize the most suitable natural reservoirs for the breeding of fish.

On the Pacific coast, the Atlantic coast, and in the Great Lakes region the usual attention has been given to salvaging the eggs of the more important commercial fishes taken in the nets of the fishermen. At western stations as many of the small salmon produced from such eggs as facilities in the various fields would permit were held in nursery ponds and reared to the larger fingerling sizes before releasing them on local spawning grounds. Every spring spawn takers are sent out from the Gloucester (Mass.) station with vessels bound for the offshore fishing banks to take ripe spawn from the cod and haddock obtained in fishing operations. As a result of such work last season over 100,000,000 cod eggs and about 50,000,000 haddock eggs were fertilized and planted on the local spawning areas, their distance from land being too far to permit forwarding the spawn to the hatcheries for development. It is believed that this work is producing substantial results. In the Michigan field attention has been given to the production of lake-trout fingerlings, and if plans now under consideration can be put into execution it is purposed to rear several million lake trout annually in the vicinity of Alpena, Mich. This work can not be extended to the rearing of whitefish, as young fish of that species can not be fed artificially.

In connection with the propagation of buffalo fish in Louisiana, a new hatchery has been erected at Pelba, where a water supply

much better suited to the work than that at the former site will be available.

The degree of success attained in shad propagation at eastern stations of the bureau has not been encouraging. The practicability of rearing shad in ponds of 100 to 500 acres in area should be determined. It is quite apparent that if the supply of this valuable fish is to be maintained in Atlantic coastal streams scientific investigations should be made to determine what regulations are necessary. In the meantime it is suggested that an annual closed season that will shorten fishing operations be provided. In addition, a weekly closed period extending from sundown Friday to sunrise Monday should be adopted and the number of nets should be curtailed and the distance between them increased. Under existing conditions fishermen are allowed to operate their nets near the mouths of rivers and to catch shad before they are in spawning condition. If a sufficient number of shad can not reach their natural spawning grounds, it will not be possible for the hatcheries to accomplish anything in shad propagation owing to their inability to obtain ripe spawn for the work. The reservation of certain areas in which shad could be allowed to spawn without molestation of any kind would do much to assist in the rehabilitation of the species in eastern rivers. Pollution and the dumping of trade wastes into many important streams has had a harmful effect on the run of shad and should be prevented.

Part 1.—FISH PRODUCTION: PROPAGATION AND RESCUE WORK

SPECIES OF FISHES HANDLED

During the fiscal year 1926 the fish-cultural work of the bureau, including artificial propagation and rescue work, involved the handling of 45 species of fishes, as follows:

LIST OF SPECIES HANDLED

CATFISHES (SILURIDÆ):
- Channel catfish (*Ictalurus punctatus*).
- Horned pout, bullhead (*Ameiurus nebulosus*).
- Mud catfish (*Leptops olivaris*).

SUCKERS (CATOSTOMIDÆ):
- Common buffalo fish (*Ictiobus cyprinella*).
- Smallmouth buffalo fish (*Ictiobus bubalus*).
- Buffalo fish (*Ictiobus urus*).

CARPS (CYPRINIDÆ): German carp (*Cyprinus carpio*).

SHADS AND HERRINGS (CLUPEIDÆ):
- Shad (*Alosa sapidissima*).
- Glut herring (*Pomolobus æstivalis*).

SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ):
- Common whitefishes (*Coregonus albus* and *C. clupeaformis*).
- Cisco (*Argyrosomus artedi*).
- Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tschawytscha*).
- Chum salmon, dog salmon (*Oncorhynchus keta*).
- Humpback salmon, pink salmon (*Oncorhynchus gorbuscha*).
- Silver salmon, coho salmon (*Oncorhynchus kisutch*).
- Sockeye salmon, blueback salmon, red salmon (*Oncorhynchus nerka*).
- Steelhead salmon (*Salmo gairdneri*).
- Atlantic salmon (*Salmo salar*).
- Landlocked salmon (*Salmo sebago*).
- Rainbow trout (*Salmo shasta*).
- Black-spotted trout, redthroat trout (*Salmo lewisi*).
- Loch Leven trout (*Salmo levenensis*).
- Lake trout, Mackinaw trout (*Cristivomer namaycush*).
- Brook trout (*Salvelinus fontinalis*).
- Brown trout (*Salmo fario*).

GRAYLINGS (THYMALLIDÆ): Montana grayling (*Thymallus montanus*).

PIKES (ESCOIDÆ): Common pickerel (*Esox lucius*).

SUNFISHES, BLACK BASSES, AND CRAPPIES (*Centrarchidæ*):
- Crappies (*Pomoxis annularis* and *P. sparoides*).
- Largemouth black bass (*Micropterus salmoides*).
- Smallmouth black bass (*Micropterus dolomieu*).
- Rock bass (*Ambloplites rupestris*).
- Warmouth bass, goggle-eye (*Chænobrytus gulosus*).
- Green sunfish (*Apomotis cyanellus*).
- Red-breasted bream (*Lepomis auritus*).
- Bluegill sunfish (*Lepomis pallidus*).
- Common sunfish (*Eupomotis gibbosus*).

PERCHES (PERCIDAE):
- Pike perch (*Stizostedion vitreum*).
- Yellow perch, ringed perch (*Perca flavescens*).

SEA BASSES (SERRANIDÆ): White bass (*Roccus chrysops*).

DRUMS (SCIÆNIDÆ): Fresh-water drum, lake sheepshead (*Aplodinotus grunniens*).

MACKEREL (SCOMBRIDÆ): Common mackerel (*Scomber scombrus*).
CODS (GADIDÆ):
Cod (*Gadus callarias*).
Haddock (*Melanogrammus æglifinus*).
Pollock (*Pollachius virens*).
FLOUNDERS (PLEURONECTIDÆ): Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

COOPERATION WITH STATES, OTHER FEDERAL AGENCIES, AND FOREIGN GOVERNMENTS

The bureau has continued to supply eggs of the brook, rainbow, and black-spotted trouts to the Canadian Government in exchange for eggs of the Atlantic salmon. Such exchanges with foreign countries have been very advantageous, as they have been the means of placing at the bureau's disposal eggs of a kind that otherwise it would have been difficult to obtain. In several instances State fisheries authorities have exchanged eggs with the bureau, and the bureau frequently has supplied eggs to a State. The State of North Carolina has aided the bureau in securing a brood stock of black bass for its Edenton (N. C.) station and has materially assisted in other ways in increasing the production of fish at that station. The bureau has aided several States in establishing fish-cultural stations and has incubated and reared fish at its hatcheries for State institutions. Particularly favorable results along this line have been secured at the White Sulphur Springs (W. Va.) and Spearfish (S. Dak.) stations.

OUTPUT

The output of the fish-cultural stations and of the rescue fields bordering the Mississippi River aggregated 5,232,373,000 fish and fish eggs. Losses in transportation amounted to 47,828, leaving a net output of 5,232,325,172 actually distributed, which shows a falling off of approximately 69,500,000 as compared with last year's figures. Almost all of the commercial fishes produced were returned to the waters from which the eggs were derived. The output of fingerling fish in 1925, in round numbers, was 136,953,000, as compared with 299,294,700 in 1926.

Summary, by species, of the output of fish and fish eggs during the fiscal year ended June 30, 1926

Species	Eggs	Fry	Fingerlings	Total
Catfish		1,400,000	30,964,500	32,364,500
Buffalo fish		105,315,000	11,258,600	116,573,600
Carp		54,500,000	40,349,500	94,849,500
Sand perch			5,000	5,000
Shad		9,143,800		9,143,800
Glut herring		55,000,000		55,000,000
Whitefish	8,320,000	200,024,000		208,344,000
Cisco	10,080,000	85,000,000		95,080,000
Chinook salmon	11,284,600	800,000	50,837,300	62,921,900
Chum salmon		18,163,500		18,163,500
Silver salmon	211,000	4,555,800	5,134,900	9,901,700
Sockeye salmon	150,000	9,795,800	64,681,000	74,626,800
Humpback salmon		1,753,500	90,000	1,843,500
Steelhead salmon	1,133,800	1,029,500	4,324,500	6,487,800
Atlantic salmon	100,000	776,000	125,600	1,001,600
Landlocked salmon	383,900	432,100	270,600	1,086,600
Rainbow trout	2,827,500	1,540,800	3,621,100	7,989,400
Black-spotted trout	8,917,800	1,473,200	3,868,400	14,259,400
Loch Leven trout	3,894,500	616,000	2,987,000	7,497,500
Lake trout	1,590,000	29,957,100	269,300	31,816,400
Brook trout	874,000	2,951,000	10,937,100	14,762,100
Silver trout			232,700	232,700
Grayling		4,823,800		4,823,800
Pike and pickerel			465,800	465,800
Mackerel		2,067,000		2,067,000
Crappie			26,741,600	26,741,600
Largemouth black bass		919,300	1,394,500	2,313,800
Smallmouth black bass		810,000	161,700	971,700
Rock bass			66,100	66,100
Warmouth bass			4,900	4,900
Sunfish			27,746,700	27,746,700
Pike perch	82,745,000	130,960,000	27,200	213,732,200
Yellow perch	7,500,000	122,501,000	2,704,400	132,705,400
White bass			42,500	42,500
Sheepshead			300	300
Fresh-water drum			130,300	130,300
Cod	429,338,000	554,629,000		983,967,000
Haddock	114,051,000	31,895,000		145,946,000
Pollock		428,788,000		428,788,000
Winter flounder	53,735,000	2,334,322,000		2,388,057,000
Miscellaneous fishes			9,851,600	9,851,600
Total	737,136,100	4,195,942,200	299,294,700	5,232,373,000

Assignments of fish eggs to State and Territorial fish commissions, fiscal year 1926

State and species	Number	State and species	Number
Arizona: Black-spotted trout	52,000	New York—Continued.	
California: Black-spotted trout	354,000	Steelhead salmon	25,000
Colorado: Loch Leven trout	336,000	North Carolina:	
Hawaii:		Glut herring	25,000,000
Chinook salmon	15,000	Lake trout	50,000
Rainbow trout	25,000	Loch Leven trout	50,000
Steelhead salmon	43,000	Rainbow trout	409,000
Idaho:		Oklahoma: Yellow perch	7,500,000
Black-spotted trout	500,000	Oregon:	
Rainbow trout	50,000	Black-spotted trout	1,000,000
Illinois:		Chinook salmon	8,136,600
Black-spotted trout	10,000	Steelhead salmon	510,000
Lake trout	50,000	Pennsylvania:	
Loch Leven trout	25,000	Cisco	2,080,000
Rainbow trout	51,800	Loch Leven trout	500,000
Silver salmon	200,000	Whitefish	5,470,000
Iowa: Rainbow trout	51,300	South Dakota: Loch Leven trout	500,000
Maine:		Utah:	
Atlantic salmon	100,000	Black-spotted trout	100,000
Lake trout	100,000	Brook trout	274,000
Maryland: Rainbow trout	104,000	Vermont:	
Massachusetts:		Lake trout	125,000
Loch Leven trout	100,000	Steelhead salmon	100,000
Rainbow trout	25,000	Washington:	
Michigan: Cisco	8,000,000	Black-spotted trout	1,825,000
Missouri: Loch Leven trout	100,000	Humpback salmon	115,000
Montana: Loch Leven trout	431,500	West Virginia: Loch Leven trout	150,000
Nevada: Black-spotted trout	50,000	Wyoming:	
New Hampshire: Chinook salmon	75,000	Black-spotted trout	485,000
New Mexico:		Lake trout	25,000
Black-spotted trout	600,000	Loch Leven trout	300,000
Loch Leven trout	500,000	Rainbow trout	250,000
New York:			
Black-spotted trout	15,000	Total	67,458,200
Lake trout	515,000		

Shipments of fish and fish eggs to foreign countries, fiscal year 1926

Country and species	Number of eggs	Number of fish	Country and species	Number of eggs	Number of fish
Argentina: Top minnows		2,000	Dominican Republic: Top minnows		15,000
Brazil:			Italy: Steelhead salmon	50,000	
Bream		100	Japan: Whitefish	2,700,000	
Crappie		75	Switzerland: Rainbow trout	72,000	
Rock bass		100	Total	3,699,000	17,275
Canada: Loch Leven trout	852,000				
Colombia: Steelhead salmon	25,000				

EGG COLLECTIONS

The degree of success attained in the collection of fish eggs depends largely upon the local conditions prevailing when the fish are spawning. If they are such that it is impossible for the commercial fishermen to set their nets or lift them at proper intervals, large numbers of eggs invariably are lost. Especially is this true with regard to operations with the commercial fishes of the Great Lakes. The various hatcheries on the Atlantic coast likewise are dependent upon the success of the commercial fishermen, though the catch is not influenced to a great extent by weather conditions. The market price of fish is a factor of considerable importance in the work of collecting eggs in this region. In the upper Mississippi Valley buffalo-fish eggs were collected from fish caught in the nets of commercial fishermen, and after being fertilized they were planted in suitable waters to be incubated under natural conditions.

Comparison of egg collections, fiscal years 1926 and 1925

Species	1926	1925	Species	1926	1925
Buffalo fish	128,100,000	140,400,000	Loch Leven trout	12,792,200	12,160,650
Carp	76,500,000	44,875,000	Brown trout	93,000	31,000
Shad	9,625,000	26,772,000	Lake trout	56,601,500	66,908,500
Glut herring	123,840,000	336,700,000	Brook trout	13,517,020	19,684,794
Whitefish	252,599,000	252,925,000	Grayling		917,000
Cisco	163,700,000	187,800,000	Mackerel	2,330,000	3,821,000
Chinook salmon	67,837,600	54,437,000	Pike perch	576,155,000	416,640,000
Chum salmon	18,860,000	17,110,000	Yellow perch	142,930,000	116,460,000
Humpback salmon	2,019,000		Cod	1,221,743,000	1,355,823,000
Silver salmon	8,520,000	11,578,000	Haddock	170,091,000	216,825,000
Sockeye salmon	59,481,490	64,465,000	Pollock	698,579,000	430,649,000
Steelhead salmon	6,473,600	4,174,969	Winter flounder	2,631,766,000	2,882,065,000
Landlocked salmon	923,450	1,263,000			
Rainbow trout	13,470,430	13,914,384	Total	6,478,453,290	6,705,428,297
Black-spotted trout	19,906,000	26,030,000			

FISH-RESCUE WORK

The State of Wisconsin has taken renewed interest in the salvage of food fishes along the western border of the Mississippi River, and in the prosecution of work in that field has greatly aided the bureau in covering the extensive territory where fish are stranded in land-locked pools. This State also has aided the bureau in distributing the salvaged fish, transporting them to their destinations in the State distribution car. Minnesota, Iowa, and Illinois also have engaged in independent rescue operations in the waters adjoining their boundaries. The territory covered by the States and the bureau has been equitably apportioned in order to avoid duplication of effort. Owing to low water stages no salvage work was undertaken during the year on the lower Mississippi River in the vicinity of Friars Point, Miss.

Number and disposition of fish rescued, fiscal year 1926

Locality and species	Delivered to applicants	Restored to original waters	Total number of fish rescued
Homer, Minn.:			
Black bass	33,811	117,463	151,274
Buffalo fish		139,870	139,870
Carp		3,795,915	3,795,915
Catfish	31,790	1,226,460	1,258,250
Crappie		3,795,915	3,795,915
Fresh-water drum		97,175	97,175
Pike and pickerel		154,630	154,630
Sunfish	217,400	10,592,700	10,810,100
White bass		13,105	13,105
Yellow perch	107,900	2,192,050	2,299,950
Miscellaneous		984,850	984,850
Total	561,511	29,033,508	29,595,019
La Crosse, Wis.:			
Black bass	4,035	25,195	29,230
Buffalo fish		1,079,500	1,079,500
Carp	160	9,034,840	9,035,000
Catfish	6,500	4,939,800	4,946,300
Crappie	10,485	2,505,515	2,516,000
Fresh-water drum		3,875	3,875
Pike and pickerel		235,700	235,700
Sunfish	40,500	2,762,500	2,803,000
White bass		18,890	18,890
Yellow perch	13,715	227,910	241,625
Miscellaneous		5,679,300	5,679,300
Total	75,395	26,513,025	26,588,420
Lynxville, Wis.:			
Black bass	15,573	36,382	51,955
Buffalo fish		551,700	551,700
Carp		10,701,000	10,701,000
Catfish	10,100	9,564,550	9,574,650
Crappie	53,410	4,296,890	4,350,300
Fresh-water drum		19,400	19,400
Pike and pickerel		9,490	9,490
Sunfish	79,825	4,675,175	4,755,000
White bass		9,625	9,625
Yellow perch	11,054	70,811	81,865
Miscellaneous	367	1,207,633	1,208,000
Total	170,329	31,142,656	31,312,985
Marquette, Iowa:			
Black bass	54,465	46,595	101,060
Buffalo fish		3,892,300	3,892,300
Carp		7,951,300	7,951,300
Catfish	30,200	12,298,800	12,329,000
Crappie		8,608,000	8,608,000
Fresh-water drum		4,700	4,700
Pike and pickerel		65,670	65,670
Rock bass	575		575
Sunfish		8,425,500	8,425,500
White bass		610	610
Yellow perch	375	78,705	79,080
Total	85,615	41,372,180	41,457,795

Number and disposition of fish rescued, fiscal year 1926—Continued

Locality and species	Delivered to applicants	Restored to original waters	Total number of fish rescued
Bellevue, Iowa:			
Black bass	1,280	1,395	2,675
Buffalo fish		5,156,100	5,156,100
Carp	200	7,647,800	7,648,000
Catfish	8,950	727,650	736,600
Crappie	9,240	56,535	65,775
Fresh-water drum		140	140
Pike and pickerel		280	280
Sunfish	15,570	54,910	70,480
White bass		225	225
Yellow perch	60	100	160
Miscellaneous	364	1,092,436	1,092,800
Total	35,664	14,737,571	14,773,235
Rock Island, Ill.:			
Black bass		1,195	1,195
Buffalo fish		430,500	430,500
Carp		1,218,000	1,218,000
Catfish		2,072,000	2,072,000
Crappie		1,292,000	1,292,000
Fresh-water drum		5,000	5,000
Sunfish		182,700	182,700
Miscellaneous		886,050	886,050
Total		6,087,445	6,087,445

STATIONS AND SUBSTATIONS AND OUTPUT OF EACH

During the fiscal year 1926 fish-cultural operations were conducted at 38 main stations and 32 substations, while fish eggs were secured in a number of collecting fields. The following table lists the stations in alphabetical order, each with its substations immediately following, and shows the output of fish and fish eggs from each point of operation.

Stations and substations operated and output of each, fiscal year 1926

[Asterisk (*) denotes transfer of eggs. See table, p. 339]

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total [1]
Afognak, Alaska:				
Sockeye salmon			10,075,000	10,075,000
Steelhead salmon		850,000		850,000
Baird, Calif.: Chinook salmon			1,590,000	1,590,000
Battle Creek, Calif.: Chinook salmon	10,000		2,072,300	2,082,300
Mill Creek, Calif.: Chinook salmon	*15,000	800,000	1,665,400	2,480,400
Baker Lake, Wash.:				
Rainbow trout			4,000	4,000
Sockeye salmon		5,275,800	187,680	5,463,480
Birdsview, Wash.—				
Brook trout			17,000	17,000
Chinook salmon	(*)		826,000	826,000
Humpback salmon		305,000		305,000
Silver salmon	201,000	1,940,000	1,170,000	3,311,000
Sockeye salmon	150,000		26,500	176,500
Steelhead salmon	68,000		278,500	346,500
Duckabush, Wash.—				
Chinook salmon			328,750	328,750
Chum salmon		10,922,600		10,922,600
Humpback salmon		539,600		539,600
Silver salmon		780,300	206,900	987,200
Steelhead salmon			34,200	34,200
Quilcene, Wash.—				
Chinook salmon			351,050	351,050
Chum salmon		7,240,800		7,240,800
Silver salmon		1,207,500	246,500	1,454,000
Steelhead salmon		100,000	249,300	349,300

[1] Lost in transit, 47,828.

Stations and substations operated and output of each, fiscal year 1926—Continued

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Baker Lake, Wash.—Continued.				
Sultan, Wash.—				
Chinook salmon	75,000		7,500	82,500
Silver salmon		628,000	584,000	1,212,000
Berkshire trout hatchery, Mass.:				
Brook trout			18,060	18,000
Rainbow trout			680	680
Smallmouth black bass			1,700	1,700
Boothbay Harbor, Me.: Winter flounder		1,487,528,000		1,487,528,000
Bozeman, Mont.:				
Black-spotted trout	550,000	200,000	226,500	976,500
Brook trout		18,000	627,000	645,000
Landlocked salmon			6,000	6,000
Loch Leven trout	*1,399,500		1,876,070	3,275,570
Rainbow trout			592,750	592,750
Glacier Park, Mont.—				
Black-spotted trout	350,000	388,200	415,000	1,153,200
Grayling		1,195,000		1,195,000
Rainbow trout			517,000	517,000
Meadow Creek, Mont.—				
Black-spotted trout	350,000	760,000		1,110,000
Grayling		3,628,800		3,628,800
Loch Leven trout	*2,470,000	488,000		2,958,000
Rainbow trout	*168,000	897,000		1,065,000
Brook trout		18,000		18,000
Cape Vincent, N. Y.:				
Largemouth black bass		50,000	13,200	63,200
Brook trout		176,000	275,900	451,900
Cisco	*10,080,000	84,800,000		94,880,000
Lake trout		1,664,000	7,500	1,671,500
Loch Leven trout		46,000		46,000
Rainbow trout		64,000	40,000	104,000
Smallmouth black bass		39,000	2,200	41,200
Whitefish	910,000	39,200,000		40,110,000
Swanton, Vt.—				
Largemouth black bass			30	30
Pike perch	*58,245,000	24,750,000		82,995,000
Yellow perch		17,290,000		17,290,000
Central Station, Washington, D. C.:				
Largemouth black bass			270	270
Brook trout			33,150	33,150
Crappie			75	75
Cisco		200,000		200,000
Pike perch		600,000		600,000
Rainbow trout			14,700	14,700
Rock bass			250	250
Sunfish			200	200
Whitefish		800,000		800,000
Bryans Point, Md.—				
Largemouth black bass			50	50
Shad		9,143,750		9,143,750
Yellow perch		96,121,000	380	96,121,380
Lakeland, Md.—				
Largemouth black bass			7,690	7,690
Crappie			3,920	3,920
Sand perch			5,000	5,000
Smallmouth black bass			50	50
Sunfish			2,820	2,820
Clackamas, Oreg.:				
Brook trout			79,200	79,200
Chinook salmon	(*)		5,750,000	5,750,000
Silver trout			21,500	21,500
Steelhead salmon	75,000		59,000	134,000
Applegate, Oreg.—				
Silver salmon			717,600	717,600
Steelhead salmon	*925,000		2,530,200	3,455,200
Big White Salmon, Wash.—				
Chinook salmon	*1,555,640		7,600,000	9,155,640
Steelhead salmon		20,000	99,800	119,800
Little White Salmon, Wash.—				
Brook trout			163,300	163,300
Chinook salmon	*9,026,000		14,733,000	23,759,000
Steelhead salmon			140,020	140,020
Rogue River, Oreg.—				
Brook trout			24,100	24,100
Chinook salmon			1,370,000	1,370,000
Silver salmon	10,000		1,946,400	1,956,400
Silver trout			44,000	44,000
Sockeye salmon			20,000	20,000
Steelhead salmon	*60,000		707,000	767,000

Stations and substations operated and output of each, fiscal year 1926—Continued

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Clackamas, Oreg.—Continued.				
Salmon, Idaho—				
Chinook salmon			10, 970, 000	10, 970, 000
Rainbow trout			134, 800	134, 800
Steelhead salmon			79, 000	79, 000
Wind River, Wash.—Chinook salmon	* 603, 000		3, 560, 000	4, 163, 000
Cold Springs, Ga.:				
Large mouth black bass		227, 300	60, 730	288, 030
Catfish			6, 820	6, 820
Sunfish			156, 500	156, 500
Craig Brook, Me.:				
Atlantic salmon	100, 000	776, 000	125, 600	1, 001, 600
Brook trout	(*)	494, 100	405, 400	899, 500
Humpback salmon		908, 900	90, 000	998, 900
Landlocked salmon	* 60, 000	146, 000	131, 650	337, 650
Grand Lake Stream, Me.—				
Brook trout		161, 000		161, 000
Landlocked salmon	323, 900	268, 500	132, 400	724, 800
Duluth, Minn.:				
Brook trout			129, 600	129, 600
Lake trout	* 25, 000	9, 663, 000	129, 000	9, 817, 000
Pike perch		16, 290, 000		16, 290, 000
Whitefish		1, 400, 000		1, 400, 000
Edenton, N. C.:				
Largemouth black bass		10, 500	102, 950	113, 450
Catfish			300	300
Crappie			1, 630	1, 630
Glut herring		55, 000, 000		55, 000, 000
Sunfish			13, 700	13, 700
Warmouth bass			150	150
Yellow perch		1, 500, 000		1, 500, 000
Erwin, Tenn.:				
Largemouth black bass		3, 500	68, 170	71, 670
Brook trout			283, 200	283, 200
Catfish			2, 100	2, 100
Crappie			440	440
Rainbow trout	131, 640		132, 560	264, 200
Rock bass			25, 020	25, 020
Sunfish			21, 200	21, 200
Yellow perch			200	200
Fairport, Iowa:				
Largemouth black bass			4, 970	4, 970
Buffalo fish			3, 640	8, 640
Carp			300	300
Catfish			2, 650	2, 650
Crappie			2, 470	2, 470
Sheepshead			270	270
Sunfish			76, 890	76, 890
Gloucester, Mass.:				
Cod	*379, 857, 000	403, 008, 000		782, 865, 000
Haddock	114, 051, 000	31, 895, 000		145, 946, 000
Pollock		428, 788, 000		428, 788, 000
Winter flounder		135, 841, 000		135, 841, 000
Homer, Minn.:				
Largemouth black bass			151, 270	151, 270
Buffalo fish			139, 870	139, 870
Carp			3, 795, 900	3, 795, 900
Catfish			1, 258, 250	1, 258, 250
Crappie			9, 889, 900	9, 889, 900
Fresh-water drum			97, 170	97, 170
Pike and pickerel			154, 630	154, 630
Sunfish			10, 810, 100	10, 810, 100
White bass			13, 100	13, 100
Yellow perch			2, 299, 900	2, 299, 900
Miscellaneous			984, 850	984, 850
La Crosse, Wis.:				
Largemouth black bass			68, 230	68, 230
Buffalo fish			1, 079, 500	1, 079, 500
Brook trout			542, 300	542, 300
Carp			9, 035, 000	9, 035, 000
Catfish			4, 946, 300	4, 946, 000
Crappie			2, 516, 000	2, 516, 000
Fresh-water drum			3, 880	3, 880
Loch Leven trout			126, 220	126, 220
Pike and pickerel			235, 700	235, 700
Pike perch			27, 200	27, 200
Rainbow trout			166, 500	166, 500
Sunfish			2, 803, 000	2, 803, 000
White bass			18, 890	18, 890
Yellow perch			241, 620	241, 620
Miscellaneous			5, 679, 300	5, 679, 300

Stations and substations operated and output of each, fiscal year 1926—Continued

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
La Crosse, Wis.—Continued.				
Atchafalaya, La.: Buffalo fish		105,315,000		105,315,000
Bellevue, Iowa:				
Largemouth black bass			2,670	2,670
Buffalo fish			5,156,100	5,156,100
Carp			7,648,000	7,648,000
Catfish			736,600	736,600
Crappie			65,770	65,770
Fresh-water drum			140	140
Pike and pickerel			280	280
Sunfish			70,480	70,480
White bass			220	220
Yellow perch			160	160
Miscellaneous			1,092,800	1,092,800
Lynxville, Wis.:				
Largemouth black bass			51,950	51,950
Buffalo fish			551,700	551,700
Carp			10,701,000	10,701,000
Catfish			9,574,650	9,574,650
Crappie			4,350,300	4,350,300
Fresh-water drum			19,400	19,400
Pike and pickerel			9,490	9,490
Sunfish			4,755,000	4,755,000
White bass			9,620	9,620
Yellow perch			81,860	81,860
Miscellaneous			1,208,000	1,208,000
Marquette, Iowa:				
Largemouth black bass			101,060	101,060
Buffalo fish			3,892,300	3,892,300
Carp			7,951,300	7,951,300
Catfish			12,329,000	12,329,000
Crappie			8,608,000	8,608,000
Fresh-water drum			4,700	4.700
Pike and pickerel			65,670	65,670
Rock bass			580	580
Sunfish			8,425,500	8,425,500
White bass			610	610
Yellow perch			79,080	79,080
Miscellaneous			570	570
Rock Island, Ill.:				
Largemouth black bass			1,200	1,200
Buffalo fish			430,500	430,500
Carp			1,218,000	1,218,000
Catfish			2,072,000	2,072,000
Crappie			1,292,000	1,292,000
Fresh-water drum			5,000	5,000
Sunfish			182,700	182,700
Miscellaneous			886,000	886,000
Yellowstone, Wyo.: Black-spotted trout	*7,667,800	125,000	2,847,000	10,639,800
Leadville, Colo.:				
Black-spotted trout			326,500	326,500
Brook trout	*600,000		3,373,900	3,973,900
Lake trout			71,000	71,000
Loch Leven trout			134,000	134,000
Rainbow trout			143,000	143,000
Steelhead salmon			37,000	37,000
Louisville, Ky.:				
Largemouth black bass			1,900	1,900
Catfish			400	400
Lake trout		14,500		14,500
Rock bass			950	950
Smallmouth black bass		525,000	5,070	530,070
Sunfish			23,300	23,300
Mammoth Spring, Ark.:				
Largemouth black bass			80,300	80,300
Catfish			1,070	1,070
Crappie			500	500
Rock bass			15,600	15,600
Smallmouth black bass			121,000	121,000
Sunfish			45,000	45,000
Manchester, Iowa:				
Brook trout			208,400	208,400
Loch Leven trout			49,000	49,000
Rainbow trout	(*)		85,450	85,450
Nashua, N. H.:				
Brook trout		100,500	479,300	579,800
Landlocked salmon			500	500
Loch Leven trout			3,340	3,340
Rainbow trout			56,400	56,400

Stations and substations operated and output of each, fiscal year 1926—Continued

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Neosho, Mo.:				
Largemouth black bass			33,040	33,040
Catfish			14,850	14,850
Crappie			3,800	3,800
Loch Leven trout			30,000	30,000
Rainbow trout	*718,515		131,885	850,400
Rock bass			4,240	4,240
Sunfish			27,800	27,800
Yellow perch			100	100
Bourbon, Mo.: Rainbow trout	583,200		14,000	597,200
Langdon, Kans.—				
Largemouth black bass			48,380	48,380
Catfish			13,700	13,700
Crappie			7,640	7,640
Rock bass			650	650
Sunfish			7,630	7,630
Yellow perch			1,000	1,000
Northville, Mich.:				
Largemouth black bass			600	600
Brook trout		644,500	205,050	849,550
Rainbow trout		102,500	47,600	150,100
Smallmouth black bass		214,000	30,100	244,100
Sunfish			3,800	3,800
Alpena, Mich.—				
Lake trout	25,000	1,659,000	60,000	1,744,000
Whitefish	150,000	19,000,000		19,150,000
Charlevoix, Mich.—				
Chub		1,400,000		1,400,000
Lake trout	*1,540,000	16,900,000		18,440,000
Steelhead salmon		26,500		26,500
Whitefish		21,700,000		21,700,000
Orangeburg, S. C.:				
Largemouth black bass			51,520	51,520
Catfish			30	30
Crappie			680	680
Sunfish			40,400	40,400
Warmouth bass			2,060	2,060
Put in Bay, Ohio:				
Carp		54,500,000		54,500,000
Pike perch	24,500,000	89,320,000		113,820,000
Smallmouth black bass			550	550
Whitefish	*7,260,000	117,924,000		125,184,000
Yellow perch	*7,500,000	7,590,000		15,090,000
Quinault, Wash.:				
Black-spotted trout			30,000	30,000
Chinook salmon			13,300	13,300
Silver salmon			263,500	263,500
Silver trout			167,150	167,150
Sockeye salmon	(*)	4,520,000	6,765,000	11,285,000
Steelhead salmon			105,000	105,000
St. Johnsbury, Vt.:				
Brook trout		1,178,374	390	1,178,764
Lake trout		56,600		56,600
Landlocked salmon		17,500		17,500
Loch Leven trout		82,000		82,000
Steelhead salmon		18,000		18,000
Holden, Vt.: Lake trout			1,800	1,800
York Pond, Vt.: Brook trout		160,560	680	161,240
San Marcos, Tex.:				
Largemouth black bass			346,100	346,100
Catfish			5,600	5,600
Crappie			230	230
Rock bass			5,580	5,580
Sunfish			64,890	64,890
Warmouth bass			1,620	1,620
Medina Lake, Tex.—				
Largemouth black bass			19,880	19,880
Rainbow trout			5,000	5,000
Steelhead salmon			5,500	5,500
New Braunfels, Tex.—				
Largemouth black bass			61,300	61,300
Sunfish			5,800	5,800
Saratoga, Wyo.:				
Brook trout			603,500	603,500
Loch Leven trout	25,000		278,630	303,630
Rainbow trout	*950,000	477,240	57,000	1,484,240
Spearfish, S. Dak.:				
Brook trout			[2] 1,293,750	1,293,750
Loch Leven trout			205,250	205,250
Rainbow trout			124,500	124,500

[2] In addition to 291,570 fingerling trout turned over to the State of South Dakota in cooperative work.

Stations and substations operated and output of each, fiscal year 1926—Continued

Stations, substations, and species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Springville, Utah:				
Black-spotted trout			37,200	37,200
Brook trout	*274,000		512,450	786,450
Catfish			100	100
Rainbow trout	72,000		494,770	566,770
Tupelo, Miss.:				
Largemouth black bass		362,500	73,230	435,730
Crappie			150	150
Sunfish			200,150	200,150
Warmouth bass			1,050	1,050
White Sulphur Springs, W. Va.:				
Largemouth black bass			38,800	38,800
Brook trout			[3] 1,445,800	1,445,800
Crappie			4	4
Loch Leven trout			281,700	281,700
Rainbow trout	*204,150		724,560	928,710
Rock bass			8,400	8,400
Smallmouth black bass			420	420
Woods Hole, Mass.:				
Cod	49,481,000	151,621,000		201,102,000
Mackerel		2,067,000		2,067,000
Steelhead salmon	5,820	15,000		20,820
Winter flounder	53,735,000	710,953,000		764,688,000
Wytheville, Va.:				
Largemouth black bass		265,500	9,820	275,320
Brook trout			220,750	220,750
Loch Leven trout			2,800	2,800
Rainbow trout	(*)		152,250	152,250
Rock bass			5,160	5,160
Smallmouth black bass		32,000	600	32,600
Sunfish			13,200	13,200
Yes Bay, Alaska: Sockeye salmon			47,606,800	47,606,800

[3] In addition to 625,000 fingerling brook trout turned over to the State of West Virginia in cooperative work.

TRANSFERS OF EGGS BETWEEN STATIONS

Large numbers of fish eggs are transferred annually between various stations of the bureau, such action being taken in the interest of economy and for convenience in distributing the product.

Transfer of eggs between stations, fiscal year 1926

Species	Number of eggs	From—	To—
Black-spotted trout	150,000	Yellowstone Park, Wyo	Clackamas, Oreg.
	255,000	do	Leadville, Colo.
	50,000	do	Do.
	175,000	do	Seattle, Wash.
	21,000	do	Holden, Vt.
	300,000	do	Saratoga, Wyo.
	200,000	do	Clackamas, Oreg.
Brook trout	175,000	Craig Brook, Me	Grand Lake Stream, Me.
	400,000	Leadville, Colo	Northville, Mich.
	350,000	do	Bozeman, Mont.
	726,000	Springville, Utah	Do.
	502,400	do	White Sulphur Springs, W. Va.
	283,000	do	Bozeman, Mont.
Chinook salmon	600,000	Mill Creek, Calif	Battle Creek, Calif.
	120,000	do	Baird, Calif.
	20,000	Clackamas, Oreg	Central Station, Washington, D. C.
	525,000	Big White Salmon, Wash	Clackamas, Oreg.
	672,000	Little White Salmon, Wash	Birdsview, Wash.
	672,000	do	Quilcene, Wash.
	3,479,000	do	Wind River, Wash.
	520,000	do	Clackamas, Oreg.
	500,000	Salmon, Idaho	Little White Salmon, Wash.
	824,200	Upper Clackamas, Oreg	Clackamas, Oreg.
	852,000	do	Do.
	1,280,000	Wind River, Wash	Do.

Transfer of eggs between stations, fiscal year 1926—Continued

Species	Number of eggs	From—	To—
Cisco	1,280,000	Cape Vincent, N. Y.	Central Station, Washington, D. C.
Cod	2,083,000	Gloucester, Mass.	Woods Hole, Mass.
Lake trout	30,000	Duluth, Minn.	Leadville, Colo.
	15,000	do	Louisville, Ky.
	1,000,000	Charlevoix, Mich.	Cape Vincent, N. Y.
	50,000	do	Holden, Vt.
Landlocked salmon	15,000	Craig Brook, Me.	Nashua, N. H.
	25,000	do	St. Johnsbury, Vt.
Loch Leven trout	156,000	Bozeman, Mont.	Do.
	150,000	do	La Crosse, Wis.
	50,000	Meadow Creek, Mont.	Neosho, Mo.
	50,000	do	Cape Vincent, N. Y.
	164,000	do	Leadville, Colo.
	150,000	do	White Sulphur Springs, W. Va.
	100,000	do	Manchester, Iowa.
	375,000	do	Bozeman, Mont.
	25,000	do	Nashua, N. H.
Pike perch	800,000	Swanton, Vt.	Central Station, Washington, D. C.
	200,000	do	Erwin, Tenn.
Rainbow trout	25,000	Meadow Creek, Mont.	Manchester, Iowa.
	50,000	do	Wytheville, Va.
	25,000	do	Holden, Vt.
	624,000	do	Bozeman, Mont.
	405,520	do	Glacier Park, Mont.
	50,000	do	Berkshire trout hatchery, Mass.
	100,000	Clackamas, Oreg.	Salmon, Idaho.
	50,000	Wytheville, Va.	Meadow Creek, Mont.
	121,330	Neosho, Mo.	La Crosse, Wis.
	91,740	do	Do.
	50,000	Saratoga, Wyo.	Leadville, Colo.
	153,000	Lost Creek, Wyo.	Saratoga, Wyo.
Sockeye salmon	25,000	Quinault, Wash.	Rogue River, Oreg.
	150,000	do	Birdsview, Wash.
	5,621,000	Yes Bay, Alaska	Baker Lake, Wash.
Steelhead salmon	125,000	Applegate, Oreg.	Clackamas, Oreg.
	50,000	do	Holden, Vt.
	50,000	do	Little White Salmon, Wash.
	250,000	do	Quinault, Wash.
	25,000	Rogue River, Oreg.	Charlevoix, Mich.
	25,000	do	Woods Hole. Mass.
	50,000	do	St. Johnsbury, Vt.
Whitefish	800,000	Put in Bay, Ohio	Central Station, Washington, D. C.
Yellow perch	6,000,000	do	Mammoth Springs, Ark.

EGG COLLECTING AT AUXILIARY STATIONS

In many instances the eggs incubated at the main hatcheries are obtained from substations located at points more or less remote. It is not always possible to operate substations for a long period, and frequently the eggs must be transferred in the green state. In other cases it is convenient to hold them at the point of collection until they are eyed. On account of the additional cost involved in operating substations, they are usually closed as soon as possible and all eggs transferred to the main stations. The following table shows the egg-collecting fields, the stations under which they are operated, the species handled, and the period of operation:

Egg-collecting stations

Station	Period of operation	Species handled
Boothbay Harbor, Me.:		
Casco Bay, Me	Mar. 2–Apr. 30	Winter flounder.
Ebenecook Harbor, Me	do	Do.
Friendship Harbor, Me	do	Do.
Georges Island Harbor, Me	do	Do.
Johns Bay, Me	do	Do.
Linekins Bay, Me	do	Do.
Mill Cove, Me	do	Do.
Pig Cove, Me	do	Do.
Muscongus Sound, Me	do	Do.
Port Clyde Harbor, Me	do	Do.
Sheepscot River, Me	do	Do.
Townsend Gut, Me	do	Do.
Bozeman, Mont.: Mystic Lake, Mont	May 11–June 30	Rainbow and Black-spotted trout.
Cape Vincent, N. Y.:		
Bath, Ontario	Oct. 29–Nov. 15	Whitefish.
Brighton, Ontario	Oct. 28–Nov. 15	Do.
Chaumont Bay, N. Y	Nov. 3–Nov. 29	Do.
Do	Nov. 16–Dec. 1	Cisco.
Fair Haven Bay, N. Y	do	Do.
Cobourg, Ontario	Oct. 28–Nov. 12	Whitefish.
Port Hope, Ontario	do	Do.
Pigeon Island, Ontario	Oct. 13–Nov. 1	Lake trout.
Simco Island, Ontario	Nov. 3–Nov. 29	Do.
Stony Island, N. Y	Oct. 17–Nov. 3	Do.
Bowmanville, Ontario	Oct. 28–Nov. 12	Whitefish.
Wellers Bay, Ontario	Nov. 12–Nov. 20	Cisco.
Clackamas, Oreg.:		
Upper Clackamas, Oreg	Aug. 15–Oct. 15	Chinook salmon.
Lemhi River, Idaho	Aug. 15–Sept. 10	Do.
Pahsimeroi River, Idaho	Apr. 1–June 1	Steelhead salmon.
Craig Brook, Me.:		
Craig Pond, Me	Oct. 29–Nov. 15	Brook trout.
Dennysville, Me	Sept. 1–Sept. 30	Humpback salmon.
Toddy Pond, Me	Oct. 25–Nov. 15	Landlocked salmon.
Duluth, Minn.:		
Bemidji, Minn	Apr. 17–May 12	Pike perch.
Big Traverse Bay, Mich	Oct. 17–Nov. 2	Lake trout.
Copper Harbor, Mich	Sept. 28–Oct. 17	Do.
Gay, Mich	Oct. 17–Oct. 29	Do.
Grand Marais, Mich	Oct. 17–Nov. 2	Do.
Huron Island, Mich	Oct. 17–Nov. 1	Do.
Isle Royale, Mich	Sept. 30–Nov. 15	Lake trout and whitefish.
Keystone, Mich	Oct. 17–Oct. 24	Lake trout.
Manitou Island, Mich	Oct. 17–Oct. 30	Do.
Marquette, Mich	Oct. 17–Nov. 3	Do.
Munising, Mich	do	Do.
Do	Nov. 15–Nov. 28	Whitefish.
Ontonagon, Mich	Oct. 17–Nov. 5	Lake trout.
Portage Entry, Mich	Oct. 17–Nov. 1	Do.
Portage Lake Canal, Mich	do	Do.
Gloucester, Mass.:		
Ipswich Bay, Mass	November to May	Cod and haddock.
Marblehead, Mass	February and March	Cod.
Plymouth, Mass	November to May	Cod and pollock.
Rockport, Mass	do	Cod, pollock, and haddock.
Leadville, Colo.:		
Baker Lake, Colo	May 3–May 20	Rainbow trout.
Bolts Lake, Colo	Apr. 19–May 10	Do.
Englebrechts Lakes, Colo	Sept. 25–Nov. 24	Brook trout.
Mount Massive Club Lakes, Colo	Oct. 21–Dec. 1	Do.
Turquoise Lake, Colo	Oct. 19–Dec. 15	Do.
Wurts Lakes, Colo	Oct. 7–Nov. 9	Do.
Northville, Mich.:		
Big Reef, Mich	Nov. 2–Nov. 27	Lake trout and whitefish.
Black River, Mich	Nov. 4–Nov. 11	Do.
Ossineke, Mich	Oct. 30–Nov. 9	Do.
Manistique, Mich	Nov. 4–Nov. 20	Do.
Naubinway, Mich	Nov. 6–Nov. 20	Do.
Cheboygan, Mich	Oct. 23–Nov. 5	Lake trout.
Presque Isle, Mich	Oct. 28–Oct. 30	Do.
Rockport, Mich	Oct. 30–Nov. 7	Do.
St. Ignace, Mich	Oct. 23–Oct. 30	Do.
Northport, Mich	Nov. 10–Nov. 20	Do.
Leland, Mich	do	Do.
Fairport, Mich	Nov. 4–Nov. 20	Do.
Epoufette, Mich	Nov. 9–Nov. 16	Whitefish.
Hammonds Bay, Mich	Nov. 16	Do.
Gould City, Mich	Nov. 8–Nov. 20	Do.
Cross Village, Mich	Nov. 9–Nov. 19	Do.

Egg-collecting stations—Continued

Station	Period of operation	Species handled
Put In Bay, Ohio:		
Port Clinton, Ohio	Nov. 3–Nov. 30	Whitefish.
Do	Apr. 12–May 10	Pike perch and yellow perch.
Do	June 3–June 29	Carp.
Toledo, Ohio	Nov. 3–Nov. 30	Whitefish.
Do	Apr. 12–May 10	Pike perch.
Catawba Island, Ohio	Nov. 3–Nov. 27	Whitefish.
North Bass, Ohio	Nov. 3–Nov. 29	Do.
Do	Apr. 15–May 1	Pike perch.
Middle Bass, Ohio	do	Do.
Do	Nov. 4–Nov. 28	Whitefish.
St. Johnsbury, Vt.: Lake Dunmore, Vt.	Oct. 5–Nov. 3	Lake trout.
Saratoga, Wyo.:		
Big Creek Lakes, Wyo	Sept. 21–Nov. 10	Brook trout.
Lost, Sage, and Canon Creeks	Mar. 24–June 25	Rainbow trout.
Springville, Utah:		
Fish Lake, Utah	Mar. 22–May 31	Do.
Do	Oct. 28–Dec. 9	Brook trout.
Strawberry Reservoir	May 25–June 20	Black-spotted trout.
Woods Hole, Mass.: Wauquoit, Mass.	Jan. 15–Mar. 30	Winter flounder.

HATCHERY FISH-CULTURAL NOTES

SHIPMENT OF EYED FISH EGGS BY THE BULK METHOD

The following item is extracted from the annual report of the superintendent of the White Sulphur Springs (W. Va.) station:

The use of the bulk method for shipping eggs that are overdeveloped, even to the slightest extent, invariably results in some indentation of the eggs; and where such a condition exists an abnormal loss is inevitable, not only during the incubation period but among the sac-stage fry. Firm advocates of the bulk method doubtless will rejoin that overdeveloped eggs should never be shipped. While admitting the truth of this contention, it is, nevertheless, not always possible to ship eggs at exactly the right stage of development, and for this and other reasons the tray method of shipment is considered preferable. If the ice hopper is kept well filled with ice and the package is maintained at the proper temperature en route, there can not be the slightest question on arrival at destination as to the condition of eggs shipped by the tray method.

TRANSPORTATION OF BROOD WINTER FLOUNDER

The superintendent of the Woods Hole (Mass.) station reports on an innovation in the method of shipping brood winter flounder from the fields where captured to the hatchery. He states:

In the transportation of the adult fish this season the conventional transportation can was abandoned entirely. In its place a large basket was used with much success. The fish were placed flat on the bottoms of the baskets, which previously had been covered with seaweed or moss. A light covering of the same material was then placed over them, and in very cold weather the baskets were covered with blankets as a further protection against frost. By this method we find less mortality and, more important, there appeared to be fewer fish with the so-called "hardened" eggs.

WATERTOWN (N. Y.) REARING STATION

Owing to lack of a suitable water supply for the production of fingerling fish at the Cape Vincent (N. Y.) station, it has been necessary heretofore to distribute the entire output of young trout in the fry stage, much to the dissatisfaction of local applicants. Under such conditions the need of a rearing center in northern New York has long been apparent, and a recent opportunity offered to engage in cooperative trout rearing with the Jefferson County

(N. Y.) Fish and Game Association at Watertown, N. Y., was taken advantage of promptly. The project controlled by the organization was fitted to receive an adequate water supply from a small spring-fed creek, and 80 rearing troughs of standard size were installed, half of them being the property of the association. The bureau supplies the young fish for stocking the project and furnishes the services of an experienced man to care for them. As a result of the first season's cooperative work at this point 287,000 trout 2 inches and over in length were produced and distributed to applicants.

EXPERIMENTAL FEEDING OF BROOD TROUT

The Wytheville (Va.) station is conducting an experiment for the purpose of determining the comparative value of various fish foods in egg production. With this in view, the 3-year-old brood stock at the station has been divided into two equal lots, one of which is fed solely on beef heart and the other on sheep liver. An equal division also has been made of the 4-year-old fish, one lot being fed on beef heart and the other on sheep liver and mush. When concluded, the results of this experiment should prove valuable in connection with future trout-cultural operations.

SHAD HATCHING IN GEORGIA WATERS

With the view of determining the value of the Ogeechee River as a shad-hatching center, experimental shad propagation was undertaken at Savannah, Ga., by the State authorities in the spring of 1926. Under the direction of the superintendent of the bureau's Warm Springs station, whose services were loaned for the purpose, a boat belonging to the State was outfitted to serve as a floating hatchery and placed in readiness to assume the work on April 1. A careful search maintained throughout the spawning period failed to disclose the presence of any shad in spawning condition until near the end of April, at which time 250,000 ripe eggs were collected, fertilized, and incubated with only a slight loss. This represented the only tangible result of the undertaking.

COMMERCIAL FISHES

The more important commercial fishes propagated by the bureau during the fiscal year 1926 were the salmons of the Pacific coast, the lake trout, whitefish, cisco, and pike perch of the Great Lakes region, the cod, haddock, pollock, mackerel, and flounder of the New England coast, the shad and river herring of Atlantic coastal streams, and the buffalo fish of the Mississippi River region. Carp in considerable numbers also were produced in connection with the work on Lake Erie.

PACIFIC SALMONS

Fish-cultural operations at the 6 main stations and 15 substations coming under this head were directed almost exclusively to the propagation of salmon. The aggregate egg collections of the group for the year shows a substantial increase as compared with last year's figures. This was due partly to the resumption of propagation work at the Afognak (Alaska) station and partly to the very successful work accomplished in the Oregon field.

Afognak (Alaska) Station

[Frank L. Snipes, Superintendent]

After a lapse of two years, for the purpose of making a tally of the run of salmon into the waters of the Afognak region, preparations for the resumption of active fish-cultural work in the propagation of sockeye salmon were undertaken with the opening of the fiscal year 1926. The run of this species into Letnik Lake during the season was again small, as compared with the large runs in years past. Only 5,544 fish were counted. This does not represent the total escapement, however, as during a period of high water a slight shifting of the rack allowed a considerable number to pass underneath, and these, together with the counted salmon, were estimated to amount to approximately 11,000. Egg collections began on August 3, and between that time and the middle of September 4,400 female fish were spawned, yielding 11,000,000 eggs of fine quality. Comparatively large numbers of silver and humpback salmon were in evidence, but as the counting weir was closed on August 15 they could not enter Letnik Lake and were forced to spawn in the river below.

During the winter of 1925–26 the weather was so mild that, with the exception of a few days in early December, all of the lakes and streams of the region remained open almost throughout the year.

With the intention of transferring the resulting spawn to the Washington stations, 2,060,000 steelhead-salmon eggs were taken during the last half of April from brood fish that enter the lake. After 1,023,000 eyed eggs had been forwarded to Seattle for distribution, such a marked rise occurred in the water temperature that it was impossible to ship the remaining eggs. They were therefore incubated and the resulting fry deposited on the native spawning grounds. On May 20, 1926, the first sockeye salmon of the season entered the lake, and by the end of June more than 18,000 had passed through the counting weir. The indications for a successful season in 1927 were therefore encouraging.

Yes Bay (Alaska) Station

[J. L. Gardner, Superintendent]

With the opening of the fiscal year 1926 approximately 20,000,000 fingerling sockeye salmon were on hand at this station. These were liberated during the months of July, August, and October in Lake McDonald. In anticipation of the fishing season the seining grounds were cleared of débris, the seining beaches extended 80 feet, and on July 20 and 21 racks and traps were erected. Shortly after this time a run of humpback salmon occurred, but no sockeyes were in evidence until considerably later. Fishing for sockeye salmon began on September 7 and was continued up to October 6, the season's collection of eggs of this species amounting to 39,680,000. While their quality as a whole appeared to be very good, the lateness of the run necessitated the handling of large numbers of green fish, and this, together with a shortage of male fish, resulted in a considerable number of unfertilized eggs. Some losses also were experienced from uneven development of the eggs in the hatchery, the eggs thus affected evidently being from diseased fish. The water during the eying period was much warmer than usual and a considerable amount of fungus developed on the eggs, involving much additional labor in caring for them. The results of incubation were fairly good, notwithstanding these handicaps, and more than 89 per cent of the entire collection hatched. The water was very low during the entire fishing season, and toward the end it became necessary to seine in the lake, the water in the river being too low to permit the ascent of the fish. At least 5,000,000 eggs were deposited naturally between the rack site and the lake in the course of the spawning period.

The use of ponds in connection with the liberation of young salmon has proved to be a decided success. The fingerling fish are placed in the ponds and allowed to pass into the lake at will, being fed at regular intervals as long as they remain in the ponds. By this means the fish gradually become accustomed to their freedom and are in much better condition than when planted direct from the troughs.

Baker Lake (Wash.) Station and Substations

[Joseph Kemmerich, Superintendent]

Fish-cultural operations were in progress in this field throughout the year at the main station and five of its auxiliaries, while eggs from the late run of chum salmon were obtained at a sixth auxiliary, at Brinnon, Wash. While weather and water conditions during the spawning season were largely unfavorable and undoubtedly occasioned some falling off in egg collections, the major part of the heavy decrease shown—the total of 26,273,000 eggs secured being little more than half as large as the collection of the preceding year—is ascribed to the altered conditions brought about through the construction of a hydroelectric dam in Baker River near the town of Concrete. Aside from the eggs collected, eggs of the sockeye, chinook, silver, and humpback salmons aggregating 10,615,000 were received from other sources and handled at Baker Lake or some of its auxiliaries.

Baker Lake (Wash.) station.—Fish-cultural operations at this station, so far as the collection of eggs is concerned, were almost a complete failure due to the erection of the dam at Concrete, Wash. The entire brood stock of sockeye salmon secured for the season consisted of the 40 fish that passed through the obstruction when the diversion channel was open during the first days of July. On July 8 the channel was closed, forcing all water through three flood gates; and from that time on the immense volume of rapidly flowing water, with the 7-foot drop at the lower end, constituted an impassable barrier to the passage of fish. Several attempts were made during the season to improvise a fishway, but they were not successful. On July 10 it was noted that brood sockeyes were congregating below the dam in considerable numbers, and the run was estimated to consist of not less than 10,000 fish. This large body of salmon remained below the structure struggling persistently in their vain efforts to surmount it, until, completely exhausted, they gradually disappeared. A large number perished in the Baker and Skagit Rivers, and by the middle of September only a very few were left. The run of chinook and silver salmon dropped back into the Skagit River, finding other suitable spawning grounds; but from all evidence obtainable there was nothing to show that any of the sockeyes deposited their spawn, and it is believed the run of that species in Baker River was a complete loss. Fifty thousand eggs were obtained from the few brood fish referred to above, and about 5,621,000 eyed eggs were transferred from the Yes Bay (Alaska) station, these two lots forming the entire stock of sockeye-salmon eggs handled in the course of the season.

Birdsview (Wash.) substation.—On account of its low water level during the spawning season of the chinook and humpback salmons no eggs from either of these species were obtainable from Grandy Creek. In an effort to locate other sources of supply all streams tributary to the Skagit River within a reasonable distance were inspected, and it was found that the waters at the mouths of most of them were spreading over a wide area and were too shallow to permit the entrance of fish. This situation was remedied so far as possible by the station employees, who spent several days in deepening and narrowing the channels so that salmon could pass through them and continue their upward journey. Eyed eggs of chinook salmon to the number of 672,000 were received from the Little White Salmon hatchery, and by means of a trap made of chicken wire enough brood fish of this species were taken in Phinney Creek late in September to yield 53,000 additional eggs. Six hundred and forty thousand fingerling silver salmon, carried over from the stock of the preceding year, were liberated early in July in tributaries of the Skagit River. Eggs of this species to the number of 2,833,000 were taken between October 30 and February 8, of which 200,000 were shipped in the eyed stage to the Lincoln Park aquarium at Chicago, Ill. The remainder was hatched and the fry liberated in due season in tributaries of the Skagit River. From 205 ripe female humpback salmon taken in a temporary trap installed in Phinney Creek 335,000 eggs were collected. These were developed with only a small loss and the product returned as advanced fry to the parent stream. About 308,000 steelhead salmon carried over from last year's stock were utilized in filling applications or planted in suitable local waters. Notwithstanding its very low water stages during most of the spring, the run of this species into Grandy Creek was the largest of any year since 1918. Between March 17 and June 4, 855,000 eggs were obtained, and had the creek been at its usual spring stage this collection probably could have been doubled. Among other shipments of

eyed eggs taken from this lot one consignment of 43,000 was sent to Hawaii. Owing to inability to forward the shipment when the eggs were at the most suitable stage of development, it was feared that the loss would be heavy. However, the eggs were reported as arriving at destination in good condition and with a loss of only 200 in transit.

Duckabush (Wash.) substation.—As the formation of the Duckabush River near its mouth is not suitable for the erection of a permanent trap, a temporary trap was built just above the Olympic highway bridge instead of under it, as was the case last year. The first of the early-run chum salmon appeared late in August, and from September 5 to October 1 eggs were taken almost daily, the total amounting to 9,000,000. As soon as the early run was over the temporary trap was removed and stored because of the danger from floods. No late-run chum salmon ascended the river as far as the location of the permanent trap, but eggs from that run were obtained at Walcotts Slough, near Brinnon, Wash., where employees of the Duckabush and Quilcene substations cooperated in collecting eggs. However, there was no room for any eggs from that source in the Duckabush hatchery, which was already filled to capacity with spawn from the early run, hence the entire collection was incubated at Quilcene. The usual run of silver salmon ascended the river during the fall and winter, but as the permanent trap was completely submerged on several occasions nearly all the fish passed upstream to spawn. The local collections, extending from November 17 to February 24, amounted to 320,000 eggs taken from 105 female fish. These, with the 750,000 eyed eggs of the same species received from one of the Washington State hatcheries, were incubated, and the resulting fry and fingerling fish were liberated in the Duckabush River. The first humpback salmon of the season appeared at the temporary trap late in August, and between September 2 and October 1, 550,000 eggs were taken from the 332 female fish secured. On account of the low water stage in the river at this time, many humpback salmon spawned in the salt water near its mouth.

In continuation of past efforts to establish a run of chinook salmon in the Duckabush River, 328,000 fingerlings, the product of a shipment of 336,000 eyed eggs of that species, were liberated in the river during the spring of 1926. As was the case during the run of silver salmon, the greater part of the steelhead salmon ascending the river during the spring passed over the permanent trap during high water stages. A few fish were taken, but most of them were too immature to be retained in pens, and only 19 were in spawning condition. From this stock 81,700 eggs were taken during the period from March 24 to May 1.

Quilcene (Wash.) substation.—In advance of the fall spawning season, a new and permanent trap, built exceptionally strong to withstand flood waters, was constructed in the Big Quilcene River on the site formerly occupied by the old trap. In anticipation of the early run of chum salmon, traps also were installed near the mouths of the Big Quilcene and Little Quilcene Rivers. Owing to the prevailing low water stage in these streams, egg collections were considerably below normal. The first of the early-run fish appeared at the temporary traps late in August; the first ripe eggs were taken on September 6, and from that date to October 6 spawning operations were conducted almost daily, 1,180,000 eggs being taken at the Big Quilcene trap and 365,000 at the other location. Almost all eggs of this species from the late run were taken at the Walcotts Slough trap near Brinnon, Wash., where collecting operations were in progress from December 1 to January 13, and 5,635,000 eggs obtained.

Early in November 336,000 eyed chinook-salmon eggs were received from the Little White Salmon hatchery. These were incubated and the resulting fry deposited in the Big Quilcene River in furtherance of an attempt to establish a run of the species in this region. Owing to the prevalence of low water in the Big Quilcene River during the greater part of the silver-salmon spawning season, the collection of eggs of that species was considerably below the total of last year. Between December 1 and February 8, 790,000 eggs were taken, and early in February 750,000 additional eggs, in the eyed state, were received from the State of Washington. The low water level prevented the collection of any humpback-salmon eggs, but on November 20, 2,000,000 eyed eggs of that species were received from the Washington fisheries authorities with the understanding that the resulting fry, in the sac stage, would be returned to be reared in a salt-water pond owned by the State in the vicinity of Quilcene.

Through the carelessness of two of the station employees, the water supply was shut off from some of the hatching throughs, during the night of February 3, and 1,100,000 fry were lost.

A portion of the stock of 338,000 steelhead-salmon fry and fingerlings on hand at the opening of the fiscal year was distributed to applicants, and the remainder was liberated in local public waters. Because of an unusually low river level, the collection of steelhead eggs, during the spring of 1926, was the smallest in the past several years, the total amounting to only 62,000. These were taken between March 5 and April 28.

Ozette (Wash.) substation.—A counting weir has been maintained in the Ozette River for the past two years, primarily for the purpose of determining to what extent sockeye salmon run into Ozette Lake. Operations at the weir having demonstrated that sockeye, silver, and steelhead salmon enter the lake in sufficient numbers to warrant the establishment of a hatchery, the next essential step was to ascertain as to the possibility of holding brood sockeye salmon from the time they run into the lake, late in May, until they are in spawning condition in October. With this end in view a survey of the Ozette watershed was made, and two locations apparently well suited to penning operations were selected, one on Ozette River, and one in Umbrella Creek.

The Ozette River inclosure, constructed on the site of the former counting weir, is of sufficient size to impound more than 1,000 fish. The Umbrella Creek inclosure was formed by building two racks about 300 feet apart, with a holding capacity for 5,000 fish.

In the early part of June, about 1,300 fish were placed in the Ozette River inclosure, but with the rising water temperature, late in that month, fungus began developing on the fish to such an extent that it became necessary to liberate them in the lake. It is intended to confine all fish caught after July 1 in the Umbrella Creek inclosure.

Sultan (Wash.) substation.—Elwell Creek, upon which this substation depends for its supplies of chinook and humpback salmon eggs, was virtually dry during most of the spawning season and remained in that condition until late October, when the humpback run was over and only a few partly spawned-out chinook salmon were available. By means of a gaff hook a sufficient number of these partially spent fish were taken near the mouth of the creek to yield 99,000 eggs. Silver-salmon eggs were collected at this point from October 25 to January 5, the total for the season amounting to 1,383,000. On January 5 Elwell Creek rose to the highest stage ever recorded, overflowing its banks and washing out a channel that finally undermined the east shore crib of the rack and completely destroyed it. This brought the silver-salmon work to an end, and as the trap could not be repaired in time for the steelhead-salmon run no eggs of that species were collected.

Quinault (Wash.) Station

[Marcus S. Meyer, Superintendent]

The daily count of sockeye salmon passing through the weir into the upper Quinault River was in progress during the first 10 days in July. The total count for the season, which began on March 19, amounted to 19,395, or about 117,000 less than the count of the previous year. In view of a recent decision by the Federal Court at Tacoma, Wash., giving the local Indians the privilege of fishing at any point on the Quinault Reservation, the bureau considered it advisable to discontinue counting operations with the close of the season.

Fish-cultural operations at this station are concerned principally with the propagation of the sockeye salmon. During the spawning season, which extended from November 2 to December 16, 2,000,000 eggs were collected in the upper Quinault River, 5,770,000 in Big Creek, 630,000 in Merriman Creek, and 80,000 in Falls Creek, the aggregate of 8,480,000 being only about two-thirds of the total number secured last year. With the exception of 175,000 eyed eggs (shipped to other stations of the bureau) and the 800,000 fingerlings on hand at the end of June, all of the young fish resulting from the collections were liberated in Quinault River and its tributaries, as were also the 5,000,000 fingerlings on hand at the beginning of the year. The eggs taken in Big Creek in past years have been conveyed to the hatchery by canoe. During the past season all collections from this source were transported by means of the station truck, thereby obviating the necessity of daily transporting the canoe to the creek.

In the absence of the counting weir, no steelhead-salmon eggs were collected during the spring, and work with that species was confined to the incubation of 250,000 eyed eggs transferred from the Applegate Creek substation, the product of which was on hand at the close of June. Small numbers of eggs of the silver and chinook salmon, taken in connection with the sockeye-salmon collections, were incubated and the fry reared to the fingerling stage before planting. The silver trout resulting from a consignment of eggs donated by the State of Washington in the previous fiscal year were distributed as yearlings. Before liberating them the right ventral and adipose fins were removed, the object in marking them being to determine if they would eventually return from salt water as larger sized fish than those that have passed their entire existence in fresh waters.

Clackamas (Oreg.) Station and Substations

[Philo B. Hawley, Superintendent]

Grouped under this head are the main station at Clackamas and its seven auxiliaries situated in Oregon, Washington, and Idaho, five of them being in operation throughout the year. Fish-cultural work consisted in the propagation of the chinook, silver, and steelhead salmons, approximately 67,000,000 eggs of which species were collected, or about 16,000,000 in excess of last year's total. In the course of the year the Oregon Fish and Game Commission rendered valuable aid not only in furnishing eggs for incubation but in giving financial assistance, thus enabling the bureau to carry out its program of producing a large number of fingerling fish for distribution.

Clackamas (Oreg.) station.—The year's fish-cultural activities at this point were initiated in August by the erection of a head rack across the Clackamas River. Owing to abnormally low water stages very disappointing results were attained in fishing for chinook salmon (conducted from September 27 to October 26), and the total number of eggs collected amounted to only 1,701,000, showing a shortage of about 50 per cent, as compared with the work of last year. All eggs were of good quality, however, and the loss during incubation was merely nominal. In the course of the year small numbers of eyed eggs of the brook trout and rainbow trout were received and incubated, and from the steelhead eggs received from auxiliaries of the Clackamas station two shipments, in the eyed stage, were forwarded to foreign countries—one to Columbia and one to Italy.

Upper Clackamas (Oreg.) substation.—Fishing for chinook salmon was in progress from August 28 to September 19, and during this time 1,721,500 eggs were secured. As no facilities for the rearing of young salmon are available at this substation, the entire collection was transferred in the eyed stage to the Clackamas station, and the substation was closed for the season.

Little White Salmon (Wash.) substation.—The stock of young brook trout and steelhead salmon on hand at the beginning of the year (about 166,000) was held for a time and then distributed to applicants or planted in suitable public waters. In August racks and traps were built in the Little White Salmon River. By September 14 chinook salmon began to appear, and on August 20 spawning operations were undertaken and conducted continuously to October 7. Eggs to the number of 29,484,000 were secured, and many millions more might have been taken had enough hatching room been available. Of these eggs 10,890,000 were shipped in the eyed stage, part of them to the Oregon Fish and Game Commission and the remainder to other hatcheries of the bureau. In the course of the year this substation received 105,000 brook-trout eggs from the Clackamas station and 50,000 steelhead eggs from the Applegate Creek substation. The resulting fry were distributed to applicants of the region.

Big White Salmon (Wash.) substation.—Work at this point was wholly on the propagation of chinook-salmon eggs, supplies of which are obtained from the Big White Salmon River and Spring Creek. Traps were erected in each of these streams early in September, and by September 10 a few brood fish had entered the Spring Creek ladder. Active spawning operations were undertaken on September 19, and between that date and October 9, 12,259,000 eggs were collected, of which about 7,000,000 were derived from Spring Creek. An important feature of the work on Spring Creek is that until within a very few years ago the run of chinook salmon in this stream was negligible. On reaching the eyed stage, 1,500,000 of the eggs were transferred to the Oregon Fish

and Game Commission and 525,000 were consigned to the Clackamas station. The fry hatched from the remaining stock were reared to the fingerling size and then liberated on local spawning grounds.

Rogue River (*Oreg.*) *substation.*—The stock of about 576,000 young brook trout, silver trout, and steelhead salmon on hand at the opening of the year was distributed later, a large percentage being deposited in the Rogue River. All natural conditions being favorable, the work of erecting the head rack on Rogue River was accomplished in June of the preceding year. On August 15 the collection of chinook-salmon eggs was begun, and between that time and the end of September 1,594,000 eggs were secured. In anticipation of the run of silver and steelhead salmon in Big Butte Creek and Elk Creek, racks and traps were built immediately after the close of the chinook spawning season, and from November 2 to January 8, 2,159,000 silver-salmon eggs were obtained, the collection being about 50 per cent larger than last year's. Due to prolonged drought and consequent low-water stages in Rogue River during the spring, the collection of steelhead-salmon eggs was disappointing, only 436,900 being secured, a little more than half the number obtained in 1925. The Oregon game commission lent one of its large trucks for making the distribution of the resulting fry, thus greatly facilitating the work.

Applegate Creek (*Oreg.*) *substation.*—The steelhead salmon on hand at the beginning of the fiscal year were liberated during July as No. 2½ fingerlings. Silver-salmon operations at this point were seriously affected by an unusually low water level in Applegate Creek, which remained at its ordinary summer stage during most of the spawning season. As the result of a slight rise in the late fall, 735,000 eggs were secured from November 16 to December 29. Shortly after the first of February a decided rise in water level in the creek induced the entrance of a comparatively large run of steelhead salmon, but continuous rains caused the stream to become so swollen that many of the fish escaped over the dam. Between February 18 and April 28, 2,864,000 eggs were collected. On attaining the eyed stage 1,500,000 were distributed to applicants and other stations of the bureau.

Salmon (*Idaho*) *substation.*—The stock of fish on hand at the beginning of the year was distributed to applicants in July. With the view of intercepting all chinook salmon entering the Lemhi River, racks were built early in May of the preceding year, and during July fish in considerable numbers were in evidence. Spawning operations began on August 17, and eggs were taken regularly from that date to September 4, the yield being 12,000,000, one of the largest collections ever made in the region. The run of salmon in the Pahsimeroi River proved negligible, and the racks and traps which had been erected on that stream early in the fiscal year were removed in September. An attempt made in cooperation with the Idaho Fish and Game Commission to collect steelhead-salmon eggs in the Pahsimeroi River proved disappointing, only 114,000 being secured. Two consignments of rainbow-trout eggs aggregating 350,000 were received during May and June, one from the State of Idaho and one from the main station at Clackamas, Oreg.

Wind River (*Wash.*) *substation.*—Fish-cultural activities at this substation (formerly operated by the State of Washington) were experimental in character, being undertaken with the view of determining the feasibility of conducting permanent work in this field. Chinook-salmon spawning operations were in progress from September 19 to October 7, resulting in the collection of 2,298,000 eggs. This total being considerably smaller than the holding capacity of the hatchery, 3,749,000 additional green eggs were transferred from the Little White Salmon hatchery for incubation. Upon development to the eyed stage, shipments aggregating 1,883,000 eggs were forwarded to the Clackamas station and to the Oregon game commission. The fry hatched from the remaining eggs were liberated in Wind River, and on February 1 the substation was closed. Heretofore logging operations have made the entrance of salmon into this stream very difficult; now that such work is virtually at an end there is a prospect that future fish-cultural operations may be followed by satisfactory results.

Baird (Calif.) Station and Substations

[W. K. Hancock, Superintendent]

The outcome of the year's work in the propagation of chinook salmon in the California field was quite encouraging, the total number of eggs collected being approximately 2,300,000 greater than in 1925 and slightly more than the total in 1924. These results were accomplished despite the fact that conditions were unfavorable, the water in the McCloud River being polluted from the middle of June to the 1st of September with a thick yellow volcanic ash from Mount Shasta.

Baird (Calif.) station.—Though traps were installed in the upper racks in the McCloud River early in the season, it is believed that a large number of the earlier run salmon passed up the river during the time repairs were being made to the 75-foot section of the upper rack mentioned in last year's report as having been washed away. Owing to the cloudiness of the water it was impossible to determine whether the racks were tight or what was the condition of the fish in the retaining pools. Seining operations were taken up on September 1 and conducted almost every evening from 7 to 10 o'clock between that date and September 4, by which time all of the early-run fish had disappeared. Brood female salmon were plentiful, but a serious shortage of male fish made it difficult to fertilize all eggs secured. A total of 1,530,000 eggs of excellent quality resulted from the season's work, this number exceeding the annual average of the past 12 years by a few thousand. As only a few of the fall run salmon enter the McCloud River, no effort was made to collect eggs from that run. On account of the prevailing low water stage in the gravity ditch a battery of troughs was set up outside the hatchery and fed from the spring until the eggs commenced to hatch, when they were transferred to the hatchery and water was pumped from the river until February 4. At that time the occurrence of heavy rains and high water made it possible to use the gravity supply. During a high water stage in February virtually all of the lower rack cribs were washed out and the upper crib was damaged considerably.

Battle Creek (Calif.) substation.—The usual arrangements for the collection of the chinook salmon eggs were taken up about September 1, at which time a crew of men was engaged to erect racks and traps and put the fishing equipment in condition for service. Owing to the low water level very unsatisfactory results were attained in seining in Battle Creek, and fishing operations soon were extended to the Sacramento River. While this involved additional labor in moving the fishing equipment, it was more than justified by the results, the total egg collections being approximately twice as large as last year.

Mill Creek (Calif.) substation.—During the latter part of August, while the creek was virtually dry, arrangements were made to set up the racks, and on November 3 fishing operations were undertaken. Between November 3 and December 4, 3,270,000 eggs of the finest quality were collected, as compared with last year's total of 2,200,000. Owing to lack of fry-holding space, 120,000 of the eyed eggs were transferred to Baird station and 600,000 to Battle Creek with the object of planting the resulting fry in waters near those stations. The remainder were hatched at the point of collection, and the product was liberated in Mill Creek as fingerling fish.

Fishes of the Great Lakes

This group consists of four main stations, four substations, and a large number of collecting auxiliaries situated along the shores of the Great Lakes, the range of operations extending from Rainy Lake, Minn., to the Vermont waters of Lake Champlain. Particular attention is paid to the propagation of such commercial fishes as the lake trout, whitefish, cisco, and pike perch, though considerable numbers of eggs of other species are hatched annually at the stations of this class and are distributed to applicants. Unfavorable weather predominated during the lake trout and whitefish spawning seasons in many of the collecting fields, materially reducing the egg collections.

Duluth (Minn.) Station

[S. P. Wires, Superintendent]

Early in the fall the usual arrangements were made for the collection of lake trout and whitefish spawn in the Michigan waters of Lake Superior. The collection of lake-trout eggs commenced September 30 at various points on Isle Royale and Copper Harbor and continued until the beginning of the State closed season, which extended from October 9 to October 16. The work was resumed on the 17th and was prosecuted successfully during the succeeding three days, the catch of trout along the south shore of Lake Superior between Ontonagon and Grand Marais being very heavy at this time. During October 19, however, heavy winds and generally unfavorable weather set in and continued almost without interruption up to the close of the spawning period on November 15. The season's collection as a whole were very light. From the total of 15,757,000 lake-trout eggs secured 10,262,000 eyed eggs, fry, and fingerling fish were developed and supplied to applicants or planted in suitable public waters. The only whitefish eggs handled were 2,320,000 that were secured by commercial fishermen operating at Isle Royale and Munising, Mich., in connection with the collection of lake-trout spawn. This stock yielded 1,400,000 fry, all of which were returned to spawning grounds in Lake Michigan waters.

Additional funds enabled this station to cooperate with the Minnesota fisheries authorities in the propagation of pike perch at the Bemidji (Minn.) State hatchery. During the spawning season—extending from April 16 to May 4—570 quarts of eggs were collected. These were cared for in the Bemidji hatchery until far enough advanced to bear transportation, when they were divided in proportion to the amount expended by each party. The bureau's share, amounting to 16,380,000 eggs, was transferred to the Duluth hatchery, and after the completion of incubation the fry were distributed to applicants. The losses on the eggs and fry during the period they were held were very light. The funds expended by the bureau for this work were applied to operating expenses only, as the State furnished all nets, boats, and other equipment and made no charge for the necessary water, fuel, or light.

The year's work at this station included the handling of 200,000 eyed brook-trout eggs received during the winter from a commercial dealer in Pennsylvania. From this stock 129,000 fry were hatched and reared to the No. 1 fingerling stage, at which time they were distributed to applicants.

Northville (Mich.) Station and Substations

[W. W. Thayer, Superintendent]

The fishes propagated at the Northville station during the year included the brook trout and rainbow trout, smallmouth black bass, and bream (*Lepomis pallidus*). During the month of January 1,157,000 eyed brook-trout eggs, most of them of fair quality, were received from various sources, some by purchase from commercial firms and the remainder through exchange. The eggs were incubated with only a small loss, but there was a heavy mortality among the resulting fry in May, due to sudden and extreme temperature changes. A large proportion of the young fish hatched from this stock was distributed to applicants in Ohio and Indiana, while comparatively small numbers were forwarded to the cooperative rearing projects at Turtle Lake and Rose City, Mich. A consignment of 150,000 rainbow-trout eggs, received during the spring from the State hatchery at Paris, Mich., was incubated, and the resulting fry were distributed with only a slight loss.

The stock of smallmouth-bass fry on hand at the opening of the fiscal year yielded more than 12,000 fingerling fish for later distribution. Of 285 adult bass of this species placed in their winter holding quarters late in the fall of 1925 only 79 were found when the pond was drained in the spring. There being no other apparent reason for this loss, it could only be concluded that the fish were stolen. At once 209 additional brood bass were obtained from Lake Erie waters and apportioned in the breeding ponds with the survivors of the original stock. Excellent weather and water conditions prevailed throughout the spawning season, and at the end of June the indications were that the yield of fry would be approximately twice that of the preceding year. Only a small brood stock of bream is held at this station, hence the output of that fish is never large.

Alpena (Mich.) substation.—Extensive improvements were made to the hatchery buildings and grounds at this station in the summer of 1925, chief among them being the excavation of a basement under the hatchery, laying cement floors in the basement and hatching room, and the installation of a 282-jar whitefish battery in the hatchery. As only a comparatively small amount of commercial fishing for lake trout was conducted in surrounding fields, a large take of eggs of that species was not anticipated. Severe storms also played an important part in reducing the collections, many of the fishermen's nets being torn to shreds, while the hauling of the nets at regular intervals was prevented by high winds. The earliest eggs were taken in the Cheboygan field on October 24, and the last were secured at Big Reef on December 21, the total for the season amounting to 3,634,500. From November 2 to November 19, 23,300,000 whitefiesh eggs were obtained from the various fields. The quality of the spawn of both species was somewhat above the average, and a good percentage of hatch was realized.

Charlevoix (Mich.) substation.—Though the work of obtaining whitefish and lake-trout eggs for stocking the Charlevoix hatchery was greatly obstructed by high winds, which prevailed almost to the end of the spawning season, the collections of eggs of both species were somewhat larger than last year. All of the spawn was much better than the average in quality. This is accounted for by the greater care exercised in fertilizing the eggs and by the application of improved methods in handling the hatchery work. The earliest lake-trout eggs of the season were taken October 23, at St. Ignace, Mich., and 36,000,000 were taken between that time and November 20. The collection of whitefish eggs began on November 6 and ended November 20, the total amounting to 27,000,000. Steelhead-salmon eggs to the number of 27,500, received during the spring from one of the bureau's stations in Oregon, were incubated with good results.

Put in Bay (Ohio) Station

[David Davies, Superintendent]

Arrangements for the collection of whitefish eggs at the various collecting points on Lake Erie were made early in November, and on the 3d of that month all necessary collecting equipment was distributed among the commercial fishermen, who were cautioned to exercise the utmost care in handling and fertilizing the eggs taken. The first lot of eggs was received at the hatchery on November 4, the season opening several days earlier than was the case during the past few years. The severe storms and generally unfavorable weather that predominated virtually throughout the egg-collecting period seriously interfered with the lifting of the fishermen's nets at regular intervals, and as a result the collection of eggs was not so large as had been expected, though it exceeded that of the previous year by approximately 1,400,000 eggs. Several million eyed eggs were furnished the Pennsylvania fish commission, and a consignment of 2,700,000 was forwarded to the Japanese Government.

The first pike-perch eggs of the season arrived at the station on April 22, the spawning season opening unusually late. For several years past the brood female pike taken for the work at this station have been quite small in size, but last year a great many were from 6 to 12 pounds in weight. The egg collection was large, being about double that of the preceding year, but the quality was very poor, less than 25 per cent producing fry. The last eggs of the season were secured on May 11.

A somewhat smaller collection of yellow-perch eggs was made than in 1925, the total amounting to 21,700,000. Of this number 6,000,000 were shipped to the Mammoth Spring (Ark.) station and 7,500,000 were furnished the Oklahoma fish commission. The remainder were hatched at the station in wire baskets suspended in water, the estimated percentage of hatch being about 92.

Early in June a temporary hatching battery for the propagation of carp was installed in one of the commercial fish houses in the Port Clinton (Ohio) field, and the work of collecting eggs, which extended from June 6 to June 24, was quite successful, 76,000,000, or approximately 100 per cent more than the total of either of the two preceding years, being obtained. With the exception of 1,000,000 fry that were placed in a pond near Sandusky Bay the entire product of the eggs collected was liberated in the Portage River several miles above Port Clinton.

Cape Vincent (N. Y.) Station and Substation

[Jno. P. Snyder, Superintendent]

Permission having been obtained from the Ontario fisheries department to collect lake-trout eggs in the vicinity of Pigeon and Simcoe Islands, in Canadian waters of Lake Ontario, active operations in those fields were undertaken on October 13. Under a permit issued by the New York conservation commission collections also were made in the vicinity of Grenadier and Stony Islands in the New York waters of the lake. Brood fish were present in the usual numbers in all these fields, but they were soon driven from the bars into deeper water by heavier wind storms, making the operating season very short. In taking trout at Grenadier Island, a locally constructed net, somewhat different from the ordinary type, was used successfully. The majority of the trout captured in all fields were either green or spent, and virtually all of the 1,100,000 eggs obtained were taken from fish caught in the evening hauls. This stock was augmented later by the transfer of 1,000,000 eyed eggs from the Charlevoix (Mich.) field.

The bureau was not permitted by the Ontario authorities to collect whitefish spawn in the Bay of Quinte and South Bay, but it was allowed to occupy fields in Wellers Bay, near Brighton, Port Hope, Cobourg, Bowmanville, and Port Whitney, Ontario, where commercial fishing is conducted on a comparatively limited scale and principally in the open waters of the lake. At the outset a large run of whitefish was in evidence at all points covered, but the favorable prospects soon were dissipated by a heavy wind storm that swept the lake with great violence, destroying or carrying away most of the fishermen's nets; and after its subsidence, more than a week later, it was found that almost all whitefish had disappeared. The effects of the storm on the New York side of the lake were very destructive also, with the single exception of Chaumont Bay, which is partly sheltered, and in this field 24,000,000 eggs (more than half the season's collection at all points) were secured. Eggs of the cisco (lake herring) were taken between November 12 and December 1, the collections aggregating 163,760,000 eggs. A noteworthy feature of the propagation of this species is that it seems to be increasing rapidly in the eastern end of Lake Ontario, while the supply in the western end of the lake apparently has undergone a material diminution. Until quite recently cisco were seen rarely in the St. Lawrence River; they are now found there in large numbers, especially within the past two years. Some 20 miles below the lake many are being taken with hook and line.

Late in December 270,000 eyed brook-trout eggs were purchased from a commercial dealer and 500,000 were received from the Pennsylvania fish commission. Fifty thousand Loch Leven trout eggs were furnished from the Meadow Creek (Mont.) field, and 160,000 rainbow-trout eggs were sent to the station by the Michigan department of conservation in return for eggs of other species. The majority of the fry derived from this stock were transferred to the Watertown (N. Y.) field station to be reared to the fingerling stage before distribution. The remaining fry were shipped to applicants soon after they were hatched.

In pursuance of a cooperative agreement 100 brood bass were supplied in advance of the 1925 spawning season for stocking Redfield Pond near Rutland, Vt., controlled by the Rutland County Fish and Game Association. During the succeeding July 89,000 bass fry of the largemouth and smallmouth species were taken from this pond for distribution, and later in the season an additional 15,425 bass in the fingerling No. 2½ stage were collected from the inclosure and used for stocking other waters.

Swanton (Vt.) substation.—Early in the fiscal year, quite extensive repairs to the station buildings and equipment were made. An arrangement was effected with the Pennsylvania fish commission whereby that organization defrayed the expense of tearing out the old pens used for holding fish and reconstructing them with new material. All of the buildings were put in good repair and painted two coats; one new live car for towing fish from the seining grounds to the pens was provided; several seine windlasses were constructed and a new seining ground cleared and made ready for operations.

The cooperative agreement in force during the past few years with the States of Pennsylvania and Vermont was renewed and everything was made ready to begin active fish-cultural work on April 1. The weather at that time was cold, however, and the lake was still covered with ice. It being evident on April 16 that the fish had commenced their annual migration up the

Missisquoi River, seining under the ice in quest of a brood stock was at once undertaken and continued as conditions permitted until April 22, when further work of that character was rendered dangerous owing to the softening of the ice. During this period, 2,272 brood-pike perch were taken, transferred to the hatchery, and placed in retaining pens. With the general breaking up of the ice on April 27, seining was resumed and continued to May 5, though it was evident that the majority of the fish had already passed into the river and some were returning, as spent fish. The brood stock acquired numbered 4,440, of which 2,880 were females. From this source an aggregate of 117,653,000 eggs was taken, and one-half of them were transferred to the Pleasant Mount State hatchery of the Pennsylvania fish commission. One million eyed eggs of the bureau's share were forwarded to the Erwin (Tenn.) station and to Central Station, Washington, D. C. The fry resulting from the rest were distributed to applicants and planted in suitable places in Lake Champlain. From 18,400,000 eyed yellow-perch eggs collected in the march adjoining the Swanton hatchery early in May, approximately 17,000,000 fry were hatched. Some of these were distributed to applicants and some were returned to parent waters.

Bryans Point (Md.) Substation

[L. G. Harron, Superintendent]

The year's work in the propagation of shad in this field is discussed on page 358 under the heading "Anadromous fishes of the Atlantic Coast." Operations connected with the preparation of the hatchery and its equipment for active fish-cultural work were undertaken on March 1. The work of procuring adult yellow perch from commercial fishermen of the region to serve as a brood stock was taken up on March 3 and prosecuted vigorously up to March 20, resulting in the acquirement of about 23,400 fish. In accordance with the usual method, these fish spawned in live cars anchored in Accokeek Creek, and 101,180,000 eggs were collected therefrom between March 24 and April 7. All of the resulting fry were liberated on the principal spawning grounds of the species in tributaries of the Potomac River. The light yield of eggs from the large brood stock on hand is attributed to the small size of the fish, the average length of the females being less than 7½ inches.

RESCUE OPERATIONS

La Crosse (Wis.) Station and Substations

[C. F. Culler, in charge]

Early in the fiscal year the central directing base for fish-rescue operations was transferred from Homer, Minn., to La Crosse, Wis., where a new hatchery, 84½ by 53¾ feet, was constructed. On the first floor of the building is a large hatching room, offices, and an aquarium for the exhibition of the fishes of the region, while storage rooms and dormitories for the use of the station employees are fitted up on the second floor. A garage, 30 feet by 36 feet, for housing the bureau's trucks, also was erected.

The rescue territory covered during the year extended from Reeds Landing, Minn., to a point about 14 miles below Bellevue, Iowa, and from Rock Island, Ill., to Montpelier, Ill. During the operation season which opened early in July and continued until late in November, 149,814,899 fish were salvaged, the cost of the work amounting to approximately 14⅓ cents per thousand. In adition to the rescue work, considerable numbers of eggs of the brook, rainbow, and Loch Leven trout are handled at this station annually. During the year cooperative agreements were entered into with the owners of several trout ponds in the vicinity of La Crosse for the collection of brook-trout eggs, and from one pond as many as 310,000 eggs were obtained. Due to lack of vitality, however, this lot was a total loss. A smaller number of eggs, secured at another point, were incubated with a loss of only 6 per cent. Late in December a consignment of 750,000 brook-trout eggs, forwarded by a commercial dealer in Pennsylvania, was found on arrival at the station to be badly frozen, and about 396,000 dead eggs were removed in the first picking. These dead eggs were replaced later by the shipment of another lot, but the fry developed from the second consignment were small and the losses abnormal. A shipment of 500,000 brook-trout eggs forwarded from a commercial hatchery in Colorado in exchange for eggs of other species apparently was in good condition on

arrival, but the fry hatched from them were afflicted with a disease known as "blue sac," and nearly all of them perished. Other shipments of brook, rainbow, and Loch Leven trout eggs were received in fine condition, and the resulting fry were strong and healthy.

Homer (Minn.) substation.—Fish-cultural operations at this station consist almost exclusively in the rescue of landlocked fishes from overflowed lands along the Mississippi River and the inoculation of considerable numbers of them with the larvæ of the commercial mussels. Game fishes also are held here for later distribution, the station having pond capacity for about 2½ carloads. During the early part of the rescue season the water level in the river was at a favorable point, but it receded later, and had it not been for frequent rains many of the pools would have become dry before the fish contained in them could be salvaged. Work was prosecuted under such conditions until October, when the operations were considerably checked by cold weather and heavy rains.

Bellevue (Iowa) substation.—Notwithstanding the fact that the water level at this point was not favorable for rescue work and only one crew of men was employed, the season's results were very satisfactory, the number of fish salvaged being 100 per cent larger than in the preceding year.

Marquette (Iowa) substation.—Rescue work at this substation is prosecuted in connection with similar operations conducted at Guttenberg, Iowa. The field is advantageously located for the distribution of fish, and its output compares very favorably with that at other collecting points.

Atchafalaya (La.) substation.—Because of the large amount of pollution carried in the water from Ouachita River, which supply was used at the hatchery site formerly occupied in the propagation of buffalo fish in the Louisiana field, the old location was abandoned and a new hatchery erected during the year on the Bayou Plaquemine, where a water supply of good quality is accessible. The material for the new hatchery, which is 20 feet by 75 feet in dimensions, was provided by the Louisiana Conservation Commission, while the work of constructing it was done by the bureau's force in connection with their regular fish-cultural duties. During the spawning season of the buffalo fish (from February 26 to April 1) 128,100,000 eggs of fine quality were obtained. These were incubated successfully and produced 105,315,000 fry, which were planted on the native spawning grounds.

Mussel Infection in Conjunction with the Rescue of Landlocked Fishes

Mussel-infection operations were conducted as heretofore in connection with the salvage of food fishes from overflowed lands along the Mississippi River. The work assumed extensive proportions and resulted in the release of 2,803,653,100 larval mussels on the gills of suitable fishes, at an average cost of only $0.00144 per thousand. Much valuable cooperative assistance was rendered by clam fishermen and others engaged in the industry, while many letters commending the work were received from clam and pearl dealers and pearl-button manufacturers. The fields in which mussel-infection operations were conducted during the year and the numbers and species of mussels handled in each are shown in the following table:

Summary of mussel-infection work, fiscal year 1926

Stations	Species		
	Grass mucket (*L. luteola*)	River mucket (*L. ligamentina*)	Pocketbook (*L. ventricosa*)[1]
Wabasha, Minn	21, 790, 000	9, 459, 000	
Alma, Wis	1, 468, 000	10, 508, 300	
West Newton, Minn		18, 339, 000	
Minneiska, Minn		94, 022, 800	
Chimney Rock, Wis	31, 576, 900		
Winona, Minn	741, 153, 000		
Homer, Minn	305, 608, 500	372, 219, 900	2, 290, 000
Dakota, Minn		9, 582, 000	
La Crosse, Wis	429, 009, 000		
Genoa, Wis	14, 569, 000	131, 531, 500	36, 665, 000
Ferryville, Wis	12, 840, 000	5, 339, 500	
Lynxville, Wis	109, 015, 000	197, 986, 000	
Marquette, Iowa		8, 404, 500	
Guttenburg, Iowa		48, 978, 000	
North Buena Vista, Iowa		3, 560, 500	
Bellevue, Iowa	12, 987, 600	21, 720, 100	
Andalusia, Ill		153, 002, 000	
Total	1, 680, 017, 000	1, 084, 653, 100	38, 955, 000

[1] This mussel is not of best quality, and fishes are infected with it only when first-class mussels are not available.

MARINE FISHES

Although the combined egg collections at the stations comprising this group did not reach the enormous total attained in 1925, they were well above the average collections of past years and the results of the fiscal year's work may be regarded as fairly successful. Eggs of the various species handled to the number of 4,571,098,000 were taken at the three stations, showing a falling off of 315,000,000 when compared with the total of the preceding year. This loss was occasioned principally by the smaller collections of winter-flounder eggs made along the Maine coast. In addition to the total named, 153,148,000 cod and haddock eggs were secured in connection with the offshore fishing operations and were planted as fertilized eggs on the grounds where taken.

Boothbay Harbor (Me.) Station

[E. E. Hahn, Superintendent]

Although a very careful watch was maintained in the hope that pollock, haddock, and cod in spawning condition might be secured, no eggs of any of those species were obtained, and the year's work at this station was confined to the propagation of the winter flounder or flatfish. Active operations for the collection of eggs of this species were undertaken on March 2, when the entire 88 fyke nets available for the work were set in desirable positions from west Penobscot Bay to Casco Bay. These were fished daily, when weather permitted, up to the close of the season in late April. Windy but otherwise average weather prevailed during the entire fishing period, and a fair number of brood fish were taken, though they were less abundant in Casco Bay than usual, and the catch as a whole was somewhat smaller than the record one of last year. Right at the busiest part of the fishing season the steamer *Gannet* was again forced out of commission because of deficient boiler stay bolts and had to be laid up for two weeks. This, of course, resulted in the loss of large numbers of eggs, as it was impossible to reach the more distant nets with the small motor boats at hand. As an outcome of the season's fishing about 5,800 brood winter flounder were captured, and from them 1,585,685,000 eggs of excellent quality were secured, the aggregate losses during incubation being estimated at less than 6 per cent.

During the summer a very good display of local fishes, seals, crustaceans, and bottom material was maintained in the hatching room, constituting a source of attraction to the many visitors to the station.

Gloucester (Mass.) Station

[C. G. Corless, Superintendent]

Pollock propagation at this station extended from early November to January 17, but could not be prosecuted to advantage during the first two months owing to the severe storms that prevailed, and the egg collections of that species up to the close of December were the most discouraging in many years. Pollock were abundant on the fishing grounds and large numbers of them were spawning, but on account of the unfavorable weather many of the fishermen allowed their gill nets to remain in the water for from two to five days at a time and when finally they were hauled most of the fish contained in them were dead. Weather conditions improved after January 1, and up to the 10th of that month 400,000,000 eggs were taken, the work of a single day netting nearly 100,000,000. The total number of eggs of this species collected during the season was 698,579,000. The collection of cod eggs for stocking the Gloucester hatchery was undertaken on November 11, and by the close of November about 56,000,000 had been secured. The indications at that time were that cod would be plentiful throughout the winter, but early in December virtually all the fish left the inshore fishing grounds, and this, together with the scarcity of all other species of marine fish, caused the majority of the gill-net fishermen to suspend operations temporarily. With the improvement of weather conditions shortly after the 1st of March fishing was resumed, and the daily egg collections from that time on to the end of the season on April 30 were large, the total number of eggs taken amounting to 844,882,000.

During the latter part of April the low density of the water caused by heavy spring freshets made it necessary to plant 277,496,000 cod eggs on the spawning grounds as soon as they were fertilized. Haddock were late in appearing on the inshore fishing ground and were much later than usual in spawning. As a rule haddock are taken in considerable numbers during March, but no spawning haddock were seen in the spring of 1926 until April 11. To April 30, the close of the spawning period, 119,304,000 eggs of this species were collected. Early in March, as soon as weather conditions made it possible, fyke nets were set along the eastern shore of Gloucester Harbor with the view of obtaining brood winter flounder, but on account of the cold backward spring the catch was smaller than usual. The 295 gravid fish taken yielded 151,821,000 eggs.

Offshore operations from this station were taken up on February 1 and continuously prosecuted to April 2. Three experienced spawn takers were detailed to the work, one being placed on an otter-trawl steamer and the other two on hand trawlers. Although the spawn takers made more trips than in past years, the catch of fish was unusually large, and every effort was put forth to secure a record collection of eggs, the results of the work did not meet expectations. This was because only a small percentage of the fish taken were ripe. As an outcome of the work in this field 102,361,000 cod eggs and 50,787,000 haddock eggs were fertilized and planted on Georges Bank.

Woods Hole (Mass.) Station

[G. R. Hoffses, Superintendent]

Generally favorable weather prevailed during the spawning season of the fishes propagated in this region, and the outcome of the year's work was satisfactory in the main. Early in October arrangements were perfected for acquiring a brood stock of adult cod from the commercial fishing traps operating at Newport and Narragansett Bay, R. I. The first lot was obtained on November 5, and later acquisitions swelled the receipts to 1,794 fish, all being of desirable quality and so far as could be determined, equally apportioned as to sex and sexual maturity. Unfortunately this station is not equipped with proper means for transporting live fish from the fishing grounds to the station, and a boat equipped with a small well for carrying lobsters had to be chartered at an expense of $100 per trip. It was estimated that this boat would carry 425 cod safely from the Newport field to the hatchery, a distance of about 4 hours' duration; but a trial trip with that number having resulted in a loss of 140, the numbers carried on later trips were successively reduced. This proved of little avail, however, as on every trip the loss of fish amounted to 25 per cent of the load carried, and it could only be concluded that the type of boat used was not suited to the work.

In an effort to transfer the 1,794 brood cod purchased there was a mortality of 794, leaving only 1,000 available for the propagation work. It being apparent quite early in the season that, with the unsatisfactory transportation facilities available, the Newport traps could not supply fish in adequate numbers for the work, the local hand-line fishermen were requested to deliver their catches to the station. By this means the brood stock was increased to 1,750 fish, which yielded in round numbers 272,000,000 eggs. After the completion of spawning operations, the fish were tagged and liberated in connection with the investigation being made by the division of scientific inquiry concerning food fishes.

The work of obtaining brood winter flounder in the vicinity of Waquoit, Mass., was undertaken on January 12. Nets were set on the following day and, weather permitting, daily trips were made to the fishing grounds from that time to March 29. From the stock thus acquired, amounting to 2,516 female fish and a suitable number of males, 894,000,000 eggs were secured and incubated, the total losses amounting to 18 per cent.

During the month of June a small collection of mackerel eggs was made. At an earlier period both mackerel and scup were abundant in waters adjacent to the station, but they disappeared to a great extent in advance of the spawing time and only a very few of either species were to be found.

Of 25,000 steelhead-salmon eggs received from the Medford (Oreg.) field, about 70 per cent were hatched. The resulting fry were planted in Childs River.

ANADROMOUS FISHES OF THE ATLANTIC COAST

The fish-cultural work at the three stations of this class, located in Maryland, North Carolina, and Maine, was concerned with the propagation of shad, river herring, Atlantic salmon, and humpback salmon. The collection of eggs of these species were small, as compared with those of 1925, the cause of the falling off being the unfavorable weather experienced during the herring spawning season and the scarcity of adult shad both in the Potomac River and in Albemarle Sound.

Shad

Bryans Point (Md.) substation.—The outcome of the season's work in shad propagation on the Potomac River was very discouraging. While scarcity of adult shad was mainly responsible for the poor results, there were other contributing factors, among them being the unfavorable weather and water conditions encountered. The first fish of the season with mature eggs was taken on April 23, and from that time on the work was earnestly prosecuted up to the close of the run on May 14. Eggs to the number of 9,625,000, all of excellent quality, were secured and incubated, and the resulting fry were returned to the more important spawning grounds in the river.

A remarkable feature of the shad work on this river is that almost no shad are now being taken on the formerly prolific spawning grounds lying between the hatchery and the city of Washington, a distance of about 14 miles. From this territory, which until quite recently yielded from 10,000,000 to 25,000,000 eggs per season, the total number of eggs obtained during the past two years has amounted to only 650,000. From all the evidence obtainable the conclusion has been reached that this desertion of a formerly favored spawning area may justly be charged to pollution brought about by the extensive discharge of sewage into the upper river at various points.

Shad and River Herring. Edenton (N. C.) Station

[William S. Vincent, Superintendent]

On account of the prevalence of heavy adverse winds and unseasonable air and water temperatures, the spring of 1926 was one of the most unsatisfactory ever experienced in this region, not only from a fish-cultural standpoint but also as concerned the prosecution of commercial fishing. Shortly before the commencement of the anticipated spawning period of the river herring the commercial fish houses of the district were visited at regular intervals in quest

of ripe fish, but none was found until April 22, the season opening about two weeks later than usual. Throughout the month of April an interval of two or three fair days was invariably followed by high winds and cold weather. Such conditions prevailed until the first week of May, when, as a result of several successive warm days, a run of herring ascended nearer to the headwaters of adjacent streams than ever before so far as the records go. In the course of the egg-collecting period, which extended to May 6, 123,000,000 eggs (approximately one-third of last year's total) were secured. As was the case in a former season, the eggs were extremely adhesive, and despite the application of every known preventive in taking them and in their subsequent care the losses during incubation were excessive, amounting to about 60 per cent of the eggs collected.

The conditions encountered at Capehart Beach were the same as last year. The daily catch of shad was invariably small, and quite frequently it consisted of fish of only one sex. On the few occasions when both sexes were represented the females were green. Daily trips were made to the fishing grounds until it became apparent that no eggs would be obtainable, when they were discontinued.

Atlantic and Humpback Salmons. Craig Brook (Me.) Station

[George N. Montgomery, Superintendent]

On account of the unreasonable attitude assumed by the commercial fishermen of the Penobscot River with reference to the conduct of Atlantic-salmon propagation at this station, no local egg collections are made, and for the past few years the work with that species has been dependent upon the transfer of eggs from hatcheries operated by the Canadian Government, such eggs being in exchange for the spawn of other fishes. In the pursuance of work along this line 553,000 eyed eggs were received early in March from South Esk, New Brunswick, and a few days later a second shipment of 546,000 arrived from Gaspe, Quebec. One hundred thousand of the latter consignment were reshipped to the State hatchery at Caribou, Me., with the view of liberating the resulting fry in the waters of that region. From the remaining eggs 900,000 fry were developed in the Craig Brook hatchery and were utilized for replenishing the supply in the Penobscot River and other streams in Maine.

The run of humpback salmon to fresh-water streams of the State being due in the fall of 1925, preparations were made in advance of the spawning season for the collection of eggs in the Dennys River. The first fish in spawning condition was obtained on September 17, and in the course of the succeeding 10 days 1,134,000 eggs were secured. The loss on this lot during the hatching period amounted to about 9½ per cent.

FISHES OF MINOR INTERIOR WATERS

The more important fishes propagated at the stations included under this heading are the brook, rainbow, Loch Leven, and black-spotted trouts, the landlocked salmon, the black basses, the crappies, rock bass, sunfishes, and catfish. Due to the great extension in travel brought about by the rapidly increasing use of the automobile and the consequent opening of heretofore almost inaccessible regions, numerous streams that formerly contained an abundance of fish life have become almost depleted. This is particularly true of the brook trout and black basses, species for which there seems to be an inexhaustable demand. The output of brook trout from the bureau's hatcheries is limited by the necessity of depending largely upon commercial establishments as a source of supply for eggs, while in the case of the black bass and other pond fishes the work of producing them is hazardously affected at some points each year by sudden changes in temperature and other unfavorable weather and water conditions. Another handicap is the inability to secure brood fish in adequate numbers, while lack of sufficient rearing space hampers the work at almost all points. In an effort to alleviate this difficulty

the bureau has taken steps to cooperate with various fishing clubs and other organizations in rearing both bass and trout to the larger fingerling sizes before supplying them to applicants or liberating them in public waters.

ROCKY MOUNTAIN TROUT STATIONS

Fish-cultural operations at this group of eight stations and substations are confined to the various species of trout found in the mountain streams and lakes of the Rocky Mountain region. The species to which special attention was given during the year were the brook, rainbow, black-spotted, and Loch Leven trouts, while at one of the stations grayling were handled in comparatively small numbers.

Bozeman (Mont.) Station and Substations

[W. T. Thompson, Superintendent]

The cooperative relations heretofore maintained with the Montana Fish and Game Department were continued throughout the year. The exchange of fish eggs on a large scale between the station and the State is proving mutually beneficial and economical. Were each organization compelled to maintain fields for the collection of the species exchanged, the expense of conducting the work would be materially increased.

Bozeman (Mont.) station.—During the excessively warm weather experienced in July a severe outbreak of Octomitiasis occurred among the brook-trout fingerlings carried over from the stock of the previous fiscal year, and about 165,000 perished before the disease could be checked. During December and January 1,569,500 eyed brook-trout eggs were acquired, of which 270,000 were donated to the station by the Southside Sportmen's Club of Oakdale, N. Y. Part of the fry hatched from this stock of eggs were distributed during the spring, and about 620,000 were on hand in the fingerling stage at the end of June. Large numbers of rainbow, black-spotted, and Loch Leven trout fingerlings were being carried at the beginning of the year, together with a small number of landlocked salmon. In advance of the distribution period these fish were attacked by the same disease that occurred among the brook trout and heavy losses resulted. In addition to a small number of eggs obtained from the station brood stock of rainbow trout, 624,000 eyed eggs of that species were transferred to the station from the Meadow Creek field. At the close of the year the young fish produced from these eggs were being reared for later distribution.

During January and February 1,796,000 eyed Loch Leven trout eggs were transferred to the Bozeman hatchery from the Meadow Creek auxiliary. All of these, with the exception of 41,000 retained at the station, were immediately repacked and shipped, some to applicants and some in exchange for eggs of other species. The entire stock of 1,554,000 black-spotted trout eggs handled was received from the Montana Fish and Game Department, the eggs having been collected during May and June near Georgetown, Mont. On reaching the eyed stage 500,000 were shipped to the New Mexico Fish and Game Department and 325,000 were used for stocking mountain lakes in Montana. The remainder were incubated in the hatchery.

Meadow Creek (Mont.) substation.—Soon after the collection of the first Loch Leven trout eggs of the season on October 13 unfavorable weather set in, which delayed further operations until about the middle of November, at which time a large run of fish appeared in the stream. Between November 15 and December 8, 12,220,000 eggs of this species were taken, establishing a new record in the work of the substation. For some unknown reason the losses of eggs were large during the incubation period, the percentage of hatch being only 72½, as compared with 90½ per cent hatched the preceding year. The rainbow trout began spawning on April 12, somewhat later than usual and between that date and May 19, 2,698,000 eggs were taken. Though considerably smaller than the collection in 1925, the quality of the eggs was far superior, the number brought to the eyed stage amounting to 92 per cent of

the whole. Eyed eggs to the number of 1,143,500 were transferred to the Bozeman and Glacier Park hatcheries; the remainder were incubated locally and the product used for restocking Madison Valley waters.

Glacier Park (Mont.) substation.—The large number of black-spotted trout fingerlings on hand at the opening of the fiscal year were planted during July and August in the waters of Glacier Park by local park officials, together with the considerable numbers of rainbow trout and grayling fry turned over to them as part of the product of the hatchery at this point. During May and June 1,486,000 green black-spotted trout eggs were received from the Montana Fish and Game Department, 350,000 of which were planted in the headwaters of some of the more inaccessible streams in the park; the remainder were on hand at the end of the fiscal year. The substation also received 519,520 rainbow-trout eggs from the Meadow Creek field and 1,075,000 green grayling eggs from one of the Montana State hatcheries. The product of the latter lot was delivered to Glacier Park officials for distribution in waters adapted to that species, while the fry hatched from the rainbow-trout eggs were carried over into the new year.

Leadville (Colo.) Station

[C. H. Van Atta, Superintendent]

All brook-trout eggs handled at this station are obtained from privately owned lakes or reservoirs, collections being made on a percentage basis. Heretofore five egg-collecting fields have been occupied, but last year, owing to a decision of the parties in control to allow outside interests to make collections in Carroll Lakes, Woodland Park, only four sites were covered. From these four 5,955,000 eggs were secured, about 50,000 less than the preceding year's total. The cost of collecting the green eggs varied from 1½ cents per thousand at Wurtz Lake to 20 cents per thousand at Turquoise Lake, the average for all fields being 6 cents. The wide variation between the two fields named is due to the fact that at Wurtz Lake all fish are seined by the owner and held in ponds awaiting the collection of the eggs by the bureau's employees, while at Turquoise Lake the fish must be seined from the lake by the bureau's men, which requires the full time of two station employees. In this connection great difficulty frequently is encountered, as the lake is liable to freeze over early in the season, and then the fish must be secured by seining for them under the ice.

At Engelbrecht Lakes the eggs are collected and cared for during the incubation period on a 30–70 basis. The owner furnishes board and lodging for the spawn taker and receives as his share 30 per cent of the resulting fry, the delivery being made at his nearest railroad station. All eggs from this field formerly were forwarded to the hatchery by train, but in the fall of 1925 the transfers were made by auto truck over a recently constructed highway until such time that it became blocked with snow. The attendant losses under the new method were greatly reduced, being less than half as large as those sustained during the previous year.

With the view of developing an egg-collecting field for rainbow-trout spawn, plants of fish of that species have been made in Baker Lake for the past four years, about 98 miles distant from the hatchery. This field station was worked for the second time in May, 1926, the yield of eggs amounting to 181,300. Bolts Lake, another rainbow-trout project, is being stocked annually with fingerling fish under a 10-year agreement, in accordance with the terms of which the bureau will receive 70 per cent of the eggs derived from its waters. From 356,000 black-spotted trout eggs received from the Yellowstone Park during the summer of 1925, 326,500 No. 1 fingerling fish were produced and distributed in waters in Colorado and New Mexico. In the course of the year the station handled 30,000 lake-trout eggs, received from the Duluth (Minn.) hatchery, 25,000 steelhead salmon eggs forwarded from the Birdsview (Wash.) field, and 50,000 rainbow-trout eggs, shipped from the Saratoga (Wyo.) station. All of these were received in excellent condition, and the fry resulting from them were still on hand at the close of the year.

Yellowstone National Park (Wyo.) Substation

[C. F. Culler, in charge]

Coming as it does in the late spring and early summer months, the fish-cultural work in this field covers portions of two fiscal years. At the beginning of July, 1925, about 6,000,000 black-spotted trout eggs were being carried in the hatchery, and the collections from that time to the close of the spawning period on July 21 brought the season's total to 11,748,000, as opposed to the collection of nearly 32,000,000 the preceding year. The principal cause for this falling off in numbers is attributed to the unusually high water stages in the streams and lakes and the abnormally low water temperatures, both of these conditions resulting from the melting of vast quantities of snow in the adjacent mountains. The low temperature in the open waters induced spawning in the much higher temperatures found on the beaches in the lakes. As an offset to the shortage in numbers, the quality of all spawn taken was of a high grade, the percentage of hatch being somewhat higher than that attained in the work the previous year.

As an experiment, 200 of the spawned-out fish were tagged before liberating them in the streams where they were captured, the object being to ascertain if they would return to the same streams to spawn in the succeeding year. Close observations made up to the close of the fiscal year 1926 disclosed the return of only three of the tagged individuals.

Saratoga (Wyo.) Station

[S. M. Ainsworth, Superintendent]

Fish-cultural operations in this field were limited to the propagation of the brook, rainbow, and Loch Leven trouts, the combined output of which exceeded that of the previous fiscal year by approximately 1,600,000. Considerable difficulty was experienced in planting the stock of brook-trout fingerlings on hand at the beginning of July, bad weather and nearly impassable roads, coupled with inability to get into prompt communication with the Forest Service employees who were to receive the fish, greatly retarding the distribution. From the station brood stock of brook trout 131,000 eggs of excellent quality were secured, the percentage of hatch exceeding 91. In the conduct of brook-trout work in the Big Creek Lakes field a heavy storm occurring early in the spawning season raised the water level of the upper lake so high that practically all of the brood fish in the traps were liberated, and before the traps could be replaced the majority of the trout had passed into the second lake, where they were inaccessible. Immediate steps taken to seine some of the fish remaining in the vicinity of the trap site resulted in the capture of a sufficient number to yield 403,000 eggs.

Arrangements were made to enter the Lost Creek field for the collection of eggs from wild rainbow trout during the last half of March, the weather being warm at that time and indicating an early spawning season. Soon after arriving on the ground, however, cold weather again set in and continued until late in April. Eggs were obtained in this field from Lost Creek, Sage Creek, and Canyon Creek between April 30 and May 26, the total number collected during the season being 1,952,000. Of these, 1,153,000 were shipped, and from the remainder 407,000 fry, representing 28 per cent of the stock brought to the eyed stage, were liberated in parent streams.

During the fall spawning season 318,000 Loch Leven trout eggs were obtained from the station brood stock of 900 female fish, almost all of which were under 3 years of age. Of the resulting fry 111,000 were planted in public waters or distributed to applicants, leaving about 159,000 on hand at the close of June.

Spearfish (S. Dak.) Station

[D. C. Booth, Superintendent]

This station accomplished a considerable amount of work in the line of pond construction during the year. Brood-trout ponds that were too shallow for carrying large fish successfully were deepened; two of them were thrown together to form one large pond and were connected with the spring-water supply from the hatchery, thus reducing the lower average of the water temperature. A series of 11 concrete nursery ponds was constructed immediately

adjoining the hatchery building and fitted up to receive spring water that has passed through the hatchery. Between October 24 and December 22 brook-trout eggs to the number of 637,200 were collected from brood fish held in the station ponds. These were of good quality and over 90 per cent of them were hatched. Five hundred thousand eyed brook-trout eggs were received from the State of South Dakota in exchange for eggs of the Loch Leven trout, and 1,118,700 additional eyed eggs of that species were handled in pursuance of an agreement entered into with the authorities of that State, whereby the State was to defray all expenses connected with the purchase of the eggs from a commercial firm while the bureau was to incubate them and care for the resulting fry until May 1, at which time they were to be divided, the State receiving two-fifths and the bureau the remainder. As a result of this cooperative work the bureau received more than 452,000 fingerling trout for distribution to applicants. The year's work at this point included the collection of 203,200 Loch Leven trout eggs and 43,200 rainbow-trout eggs from the station brood stock, all of which were incubated with only small losses.

Springville (Utah) Station

[Claudius Wallich, Superintendent]

The year's fish-cultural work in this field was concerned with the propagation of the brook, rainbow, and black-spotted trout. Though the stock of eggs handled in the course of the year was large, none of the resulting fry were distributed until the No. 1½ fingerling stage had been attained, and more than 37,000 were from 5 to 6 inches long when disposed of. All of the fish were in first-class condition when shipped, and as only a comparatively small number of the larger sizes could be carried to a can, their distribution involved numerous messenger trips. The brook-trout work at Fish Lake, Utah, was taken up early in October, at which time one of the station employees was detailed there at the request of the State fish commission to assist in guarding the brook trout from the depredations of poachers. The first eggs taken in this field arrived at the main station on October 28, and further shipments, extending to December 9, brought the total receipts for the season up to 2,836,000, of which number 85 per cent were brought to the eyed stage. Shipments of eyed eggs totaling 1,785,000 were forwarded to applicants and other stations of the bureau. The remainder were incubated at the station.

The rainbow trout on hand at the opening of the fiscal year were carried to the No. 3 fingerling stage before being distributed. Eggs were taken from the brood stock of this species held in the station ponds between November 27 and March 17, the yield (from 1,137 female fish) amounting to 1,669,700 eggs. Though extreme care was exercised in the impregnation of the eggs, for some unknown reason, the percentage of fertilization was poor, and only a little over half of the collection hatched. From eggs secured from wild stock at Fish Lake, during the spring, in cooperation with the State of Utah, the station acquired 950,000 additional spawn. Some of the eggs were of inferior quality, but later receipts were of a much higher grade and yielded a large percentage of fry. No black-spotted trout egg collections were undertaken by the station force and the year's work with this species was confined to the incubation of 265,000 green eggs, received in connection with collections made by the State fish commission in Strawberry Reservoir. The fertility of these eggs was also poor, only about 47 per cent of them producing fry.

NEW ENGLAND TROUT AND SALMON STATIONS

The four stations comprising this group are located in Maine, New Hampshire, Vermont, and Massachusetts. Their work and that of their substations is concerned principally with the brook and rainbow trout and the landlocked salmon, though small numbers of lake trout, Loch Leven trout, smallmouth black bass, steelhead salmon, and humpback salmon also appear in their tables of output.

Berkshire (Mass.) Station

[W. H. Thomas, Superintendent]

The station brood stock of brook trout, consisting of 104 adults and 72 yearling fish, yielded 216,000 eggs. These eggs began hatching early in January, and incubation was completed on March 2, about 82 days from the time they were taken, the average water temperature for the period being 45°. Hatching proceeded satisfactorily, and the young fish appeared to be healthy up to January 19, when the fry from the oldest lot of eggs began settling to the bottom and lower ends of the trough. On January 23 the second oldest lot of fry began to show signs of disease, and each of the remaining lots was similarly affected on reaching the same age. By February 2 the disease among the two oldest lots of fish had reached an advanced stage and finally resulted in the loss of all fry in the hatchery except about 11,000. In the last week of December 150,950 brook trout eggs of excellent quality were received from the South Side Sportsmen's Club of Long Island. They were divided into two lots, one lot being carried in spring water at an average temperature of 44°, while the other was placed in pond water at 40°. At the expiration of 34 days the eggs in the spring water had hatched, but the period of incubation of those held in pond water was extended to 51 days. Both lots were of uniformly good quality and there was no unusual loss. At the close of the year, however, the fish held in spring water averaged 1¾ inches in length while those retained in pond water were one-half inch shorter. A consignment of 57,500 rainbow-trout eggs was received from the Bozeman (Mont.) field on June 8, and the resulting fry were on hand at the end of the year. No brood bass were obtained for breeding purposes, but 1,660 Nos. 3 and 4 fingerling smallmouth black bass, carried over from the work of the previous year, were distributed in November, 1925.

Craig Brook (Me.) Station and Substations

[George N. Montgomery, Superintendent]

Under the heading "Anadromous fishes of the Atlantic Coast" (p. 359) will be found a summary of the operations at this station in the propagation of Atlantic salmon and humpback salmon. During the fall of 1925, 25,500 fingerling land-locked salmon ranging in length from 2 to 3 inches, which had been carried over from the stock of the previous fiscal year, were distributed to applicants and planted in suitable public waters. From adult landlocked salmon taken in trap nets set in Toddy Pond 5,165 eggs were collected and early in November 124,050 green eggs were received from the Green Lake substation. On attaining the eyed stage 110,000 of these eggs were supplied to applicants and to other stations of the bureau; the remainder (about 10,000) were hatched at the station, together with 200,000 eyed eggs of this species transferred from the Grand Lake Stream substation and 218,250 transferred from the State hatchery at Caribou, Me. All of these were incubated with merely nominal losses, and the resulting fish were released in suitable waters as advanced fry and fingerlings or reserved at the station to be reared to a larger size. Brook-trout eggs (13,630) collected from brood fish in the station ponds were of poor quality, only about 46 per cent of fish hatched from them surviving to the No. 1 fingerling stage. Other eggs of this species included 580,000 eyed eggs received from dealers in Pennsylvania and Massachusetts in exchange for those of other species and 751,000 purchased from commercial dealers in Maine and New York, 175,000 of the latter being used for stocking the Grand Lake Stream hatchery. An excellent percentage of hatch was secured from all these eggs excepting those received from the Maine dealer, on which there was a loss of about 36 per cent. All of the young brook trout resulting from this stock were distributed during the spring or planted in suitable public waters, with the exception of 143,000 fingerlings. These were on hand at the close of the fiscal year.

Grand Lake Stream (Me.) substation.—Late in the fiscal year 1925, 150,000 landlocked-salmon fry were placed in the canal ponds and fed at regular intervals from three to five times a day on a diet of sheep plucks. It was noted that after eating all particles of the heart and liver in sight the fish would greedily consume the lungs, which floated on the surface of the water. The 132,405 strong, healthy fish resulting from this lot were liberated as 3-inch

fingerlings in Grand Lake and its tributaries during September. It having been noted that virtually all losses among the fish held in these canal ponds occur during July, when the water is comparatively warm, steps were taken to counteract this condition by providing a stronger flow of water through the ponds, thus obviating sudden changes in temperature to a great extent. Preparations for the collection of landlocked-salmon eggs were undertaken on October 18, when arrangements were made to set trap nets above the screen at the dam in Grand Lake. From the three trap nets operated 339 female and 264 male landlocked salmon were taken, this stock yielding 799,400 eggs of good quality. The adverse weather encountered during the fall tended materially to reduce the collections. An effort to obtain lake-trout eggs in Grand Lake during the month of October met with complete failure. High winds and rising water interferred with the nets and no fish were captured. From the stock of 175,000 brook-trout eggs transferred from the Craig Brook station 166,000 fry were produced, all of which were distributed to applicants with the exception of 5,000. These were on hand at the close of the year.

Green Lake (Me.) substation.—On October 15 traps were installed in Great Brook and Green Lake, and during the run of landlocked salmon in these streams 30 male and 65 female fish were captured, from which 120,050 eggs of fine quality were taken. It being impossible to develop the eggs in the water on hand at Green Lake, they were forwarded to the main station to be incubated.

St. Johnsbury (Vt.) Station and Substation

[A. H. Dinsmore, Superintendent]

This field includes the work at the main station at St. Johnsbury and at the York Pond (N. H.) substation located in the White Mountain forest reserve. In the course of the fiscal year the substation at Holden, Vt., was transferred to the division of scientific inquiry of the Bureau of Fisheries, to be used as a base for conducting experiments in the feeding of fish and the treatment of diseases of the Salmonidæ. Operations at St. Johnsbury station were confined to the incubation of trout eggs and the distribution of the fry hatched from them. The work at York Pond substation was principally of a constructive type, though it included the handling of a comparatively small number of brook trout.

St. Johnsbury (Vt.) station.—As in the previous year, arrangements were made to hatch brook-trout eggs collected at Darling Pond, Vt., the bureau receiving as its share of the product one-third of the fry hatched. The usual number of brook-trout eggs were purchased from commercial fish culturists, and two local fishing clubs delivered a considerable number of these eggs to be incubated at the hatchery with the understanding that the resulting fry would be returned to them for deposit in certain public waters in the State. The losses on stock obtained from commercial firms were somewhat above normal, especially during the fry stage. About 1,343,000 eggs of this species were handled during the season, and the output exceeded that of the preceding year by more than 100 per cent.

The usual lake-trout egg collections were made at Lake Dunmore in cooperation with the State of Vermont during a period extending from October 25 to November 3. The bureau's share of these eggs was incubated at the St. Johnsbury and Holden stations, and the resulting fry were delivered to applicants and planted in local waters. The station received a consignment of steelhead-salmon eggs shipped from the Pacific coast, one of Loch Leven trout eggs from the Bozeman (Mont.) field, and another of landlocked-salmon eggs from the Craig Brook (Me.) station. All of these were hatched successfully with the exception of the last-mentioned lot, on which there was an unusually heavy loss.

York Pond (N. H.) substation.—Development work on this project, which is intended eventually to supply a large part of the brook-trout eggs the bureau is now compelled to purchase, has been in progress whenever weather conditions would permit. Work on the west branch of the diversion ditch was greatly impeded by unfavorable weather. However, the clearing of the ground and the excavation of about 1,400 feet of the ditch was accomplished during the fall, and the work was resumed early in May. A road machine operated by a tractor was secured, and with the exception of some high places the

entire 14,000 feet of ditching was completed. Brook-trout spawning operations began on September 24 and continued to November 13, during which time 313,000 eggs were taken from the 851 female fish collected in the station ponds. These eggs, with the exception of 15,000 that were shipped to the Holden station, together with 60,000 forwarded from St. Johnsbury station, were incubated at the York Pond substation, and the resulting fry were released in local waters.

Nashua (N. H.) Station

[J. D. De Rocher, Superintendent]

The brook-trout eggs obtained from the station brood stock were of such poor quality that only about 98,000 of the 155,000 collected were hatched, and the losses in the fry and fingerling stages were very large. This stock of eggs was supplemented by 892,000 purchased from commercial fish culturists in Pennsylvania, and 98,980 were received from the State of Massachusetts in exchange for eggs of the Loch Leven trout. A higher degree of success attended the incubation of these eggs, though the losses on the resulting fry and fingerling fish were heavy. From the total number of eggs of this species purchased and received through exchange 743,000 fingerling fish were produced, part of which were distributed before the close of the year. In addition to the brook-trout eggs referred to above, 164,720 were donated to the station by a commercial fish-culturist in New York State. This lot appeared to be of fair quality when received, but the fry hatched from them were weak and died rapidly, scarcely any of them reaching the fingerling stage.

Very heavy losses attended the work with the station brood stock of rainbow trout. From 156,000 eggs of this species taken during the fall and laid down for incubation in the hatchery only 32,000 fingerling fish were produced for distribution during the spring. Approximately 17,000 fingerling Loch Leven trout were produced from 25,000 eggs forwarded from the Bozeman (Mont.) field, and 10,150 landlocked-salmon fingerlings resulted from 15,150 eyed eggs transferred from the Craig Brook (Me.) station. Both these lots of fish were on hand at the close of the fiscal year.

For a number of years past the hatchery and water supply have been in very poor condition. An appropriation for making needed improvements was secured recently and the work of reconstruction is now in progress.

COMBINATION TROUT AND POND STATIONS

The five stations comprising this group are located in Iowa, Missouri, Tennessee, Virginia, and West Virginia. Their output during the fiscal year 1926 aggregated approximately 6,000,000 fish, the species represented being brook trout, rainbow trout, Loch Leven trout, largemouth black bass, smallmouth black bass, rock bass, bream, crappie, and catfish. In addition to the distribution of fish, a considerable number of rainbow-trout eggs were furnished in the eyed stage to applicants and to other stations of the bureau.

Erwin (Tenn.) Station

[A. G. Keesecker, Superintendent]

In the course of the year a number of improvements were made to the pond system at this station, among the more important of them being the construction of a cement wall about 180 feet long on both sides of pond No. 38 to protect the banks from erosion and the depredations of muskrats. Other changes included the installation of a new outlet in pond No. 33 and an emergency water inlet in this pond and also in pond G.

The fish-cultural work was concerned with the propagation of rainbow and brook trout, largemouth black bass, rock bass, and sunfish; and small numbers of catfish, crappie, and goldfish were produced incidentally. The collection of eggs from the station brood stock of rainbow trout was taken up on November 2 and was continued at semiweekly and weekly intervals to January 12, the yield aggregating 644,500. As many of the brood fish were young the losses of green eggs were unusually heavy, only 64 per cent reaching the eyed stage.

Shipments totaling 131,640 eyed eggs were forwarded to the State hatcheries at Waynesville and Marion, N. C., and the young fish hatched from the remainder were distributed as fingerlings to applicants. During the spring of 1926, 24,580 eyed rainbow-trout eggs were received from the Madison Valley (Mont.) field. The product of these will be utilized to augment the station brood stock. In its work with the brook trout this station always has depended upon purchases of eggs from commercial fish-culturists, but during the past season 396,000 brook-trout eggs were received from a dealer in Pennsylvania in exchange for eggs of other species. The fry resulting from these eggs were reared to fingerlings Nos. 1½ and 2 before being distributed.

The total output of pond fish of all species slightly exceeded that of the previous fiscal year, and about 50,000 black bass, rock bass, and sunfish were on hand at the close of the year.

Manchester (Iowa) Station

[G. H. Gill, Superintendent]

The serious damage to the station occasioned by the flood in June, 1925, which included the loss of virtually all brood fish on hand, was largely repaired in the course of the fiscal year 1926. The large quantities of sand and refuse deposited were removed from the ponds and grounds, the roadways were rebuilt, broken pipe lines replaced, and a new 55-foot truss bridge with cement flooring was constructed across Spring Branch. A retaining wall 190 feet long, 10 feet high, and 2 to 3 feet thick was built as a protection against future floods.

A considerable number of adult rainbow trout that escaped during the flood into Maquoketa River and Spring Branch were later recovered by seining. This stock of 650 fish yielded 419,000 eggs, of which 111,000 in the eyed stage were exchanged for eggs of the brook trout. The remainder were incubated. During the spring a consignment of 25,000 eyed eggs from wild rainbow trout, received from the Bozeman (Mont.) field, were successfully incubated. The product of these eggs will be reared for a future brood stock. In addition to the older brood fish on hand, the station has about 800 yearling rainbow trout and a large number of 8 to 10 inch fingerlings, and it is anticipated that it will soon be in a position at least to equal its former large production of eggs.

During November and December 700,000 brook-trout eggs and 100,000 Loch Leven trout eggs, all of them eyed, were received. The former lot, furnished by a commercial dealer in Colorado in exchange for eggs of other species, was incubated with light loss, and about half of the product was distributed as fingerling fish. The remainder are being held for later distribution. An excellent percentage of hatch was attained from the Loch Leven trout eggs, and all but 36,000 of the resulting fingerlings were distributed prior to June 30.

Owing to the loss of brood stock and the damage to the ponds, only a negligible number of pond fishes were produced. These were being held at the close of the season for distribution when the ponds are drained in the fall. Small numbers of brood largemouth black bass, smallmouth bass, and sunfish have been secured, and the production of these fishes on a larger scale will be resumed during the coming season.

Neosho (Mo.) Station and Substations

[J. P. Snyder, in charge]

As in the past, fish-cultural activities at this station were directed mainly to the propagation of rainbow trout and largemouth black bass, though small numbers of fish of other species were produced incidentally. The largest season's collection of rainbow-trout eggs ever made here was obtained from the station brood stock between November 1 and February 28, the total amounting to 1,640,000, of which 77 per cent were developed to the eyed stage. Eyed eggs to the number of 1,081,000 were supplied to applicants and to other hatcheries of the bureau. When the fry hatched from the remaining eggs were a month old they were suddenly attacked by some disease, the most noticeable symptom being a swift darting and whirling motion. They refused to eat, became thin, and the death rate increased rapidly. Light salt baths were given without apparent effect, but a marked and immediate improvement was shown in the condition of a lot that was immersed experimentally in a

strong brine solution. The darting circling movement ceased at once, the fish fed ravenously and began to make a rapid growth. All the affected fish in the hatchery were then given the same treatment, and two weeks later on the reappearance of some of the symptoms, these were quickly dispersed by another application of the solution. From that time on the fish gained in health and there was no recurrence of the trouble. Many of them were distributed in the spring, and all that remained on hand at the close of the year were normal in every respect, being at that time fingerlings from 2½ to 5 inches long.

From 50,000 eyed Loch Leven trout eggs received from the Bozeman (Mont.) field 49,700 fry were hatched. At the outset the young fish appeared to be in good condition, but they weakened later and many died, the remedial measures resorted to affording but little relief. The survivors, amounting to about 40 per cent of the original stock, were distributed to applicants in the No. 2 fingerling stage.

The outcome of the work in the propagation of the pond fishes was materially less successful than in 1925, the distribution of all species amounting to only 83,755, as compared with 152,072 in the preceding year.

Bourbon (Mo.) Substation.—This station is operated under a cooperative agreement with the Von Hoffman Press Estate, of St. Louis, Mo., and in accordance with its terms the bureau receives a certain percentage of all eyed rainbow-trout eggs produced, that being the only species of fish handled. As the result of a large loss of brood fish early in the season, the rainbow egg collections made between November 15 and February 15 proved somewhat disappointing. The bureau received 583,185 eyed eggs as its share and shipped them all to applicants in Missouri, Colorado, and Arkansas.

Langdon (Kans.) substation.—In addition to the fish obtained from the Catte ponds, which are leased by the bureau, considerable numbers of fish were purchased from owners of ponds in the immediate vicinity. The results of the year's work in this field were about the same as in the preceding year.

White Sulphur Springs (W. Va.) Station

[Edw. M. Haynes, Superintendent]

Air and water conditions during the year were in the main suitable for fish-cultural operations, and under these favorable auspices the station was able to produce a record output of brook trout and rainbow trout. One of the most favorable features of the work was the comparative freedom from fish diseases. Though all available space in the troughs and ponds was crowded to its utmost capacity throughout the season, the percentage of eggs hatched was excellent while the losses of fry and fingerling fish were small and all stock was strong and vigorous when distributed.

At this station the brood stock of rainbow trout consists principally of fish 2 and 3 years old, past experience having demonstrated that young fish are apt to be stronger and more virile than older ones and their eggs of a better quality. The policy has therefore been adopted of liberating the older stock in local streams immediately after the close of the spawning season and replacing them with young fish reared for the purpose. The rainbow trout began spawning on October 28, about two weeks earlier than last year, and the last eggs of the season were taken on January 11. The yield amounted to 1,480,000, of which 71 per cent were brought to the eyed stage. A total of 229,150 eyed eggs was shipped to applicants and other stations of the bureau. The remainder were hatched and the product reared to the fingerling stage, at which time most of them were distributed. Part of the 20,000 fish of this lot on hand at the close of the year are intended for brood stock.

As only a few adult brook trout are maintained at this point, the egg collections aggregated only 67,000. In pursuance of a cooperative agreement the State of West Virginia purchased 1,002,000 eyed brook-trout eggs from a commercial dealer for incubation in the station hatchery, and 1,301,100 eggs were acquired from other sources, principally through exchange for eggs of other species. Virtually all of the eggs were of fine quality and produced healthy fry, the percentage of hatch on the various lots ranging from 93.2 to 98.4 per cent. Among them were 5,000 eggs from albino trout, donated by the Minnesota fish commission. The fish from this lot will be reared for use as a brood stock.

A brood stock of Loch Leven trout produced 47,000 eggs, and a consignment of about 290,000 eggs of this species were received from the Bozeman (Mont.) field, of which 150,000 were the property of the State of West Virginia. The State's share of the product of these eggs was turned over to the proper authorities in the fingerling stage for distribution in West Virginia waters.

Owing to the high altitude of this station its work with pond fishes is curtailed quite frequently by sudden fluctuations in temperature. The work of the past year along that line proved no exception to the general rule, and the results of such efforts were small.

Wytheville (Va.) Station

[C. B. Grater, Superintendent]

The abnormally dry weather that prevailed in the fall of 1925 seriously impaired the quality of rainbow-trout spawn and curtailed the egg-collecting period, which was more than three weeks shorter than in any previous year in the station's history. Eggs to the number of 427,000 were collected between October 29 and January 20, this total being less than half the yield of the preceding year. The unfavorable water conditions were clearly reflected in the losses of eggs and fry, approximately 39 per cent of the stock perishing before reaching the fingerling stage. Hardening of the food sac occasioned considerable loss, this abnormal condition persisting until long after all fry had begun feeding; while popeye and Octomitiasis figured extensively in the heavy mortality that occurred among the finger-ling fish. The fry hatched from a consignment of 25,000 rainbow-trout eggs received from the Montana field were healthy and vigorous. This lot will be held and reared as a future brood stock for the station.

The same diseases that were encountered in the propagation of the rainbow trout virtually nullified the results of the work with the brown trout. Of the 76,000 fry of that species hatched from eggs taken in the fall of 1925 from the station brood stock only about 3 per cent survived to the No. 2 fingerling stage. Four hundred thousand brook-trout eggs received from a commercial dealer in Pennsylvania in exchange for eggs of the Loch Leven trout furnished by the Bozeman (Mont.) station were only of fair quality, and the distribution of the resulting fingerlings was much smaller than that of the preceding year.

Fairly successful results were attained in the work with the pond fishes, and the total output of fish of that class exceeded that in 1925 by more than 65,000. As in past years, considerable difficulty was experienced in obtaining a brood stock of largemouth bass, and with the view of obviating difficulties along that line during the coming season a number of yearling fish are being reserved to supplement the brood stock. The yield from the 230 adults of this species amounted to 265,000 fry and fingerlings. The distribution of this stock was made during May and June.

The results attained with 42 adult smallmouth black bass transferred from the Lake Erie field in the fall of 1925 are considered encouraging, especially in view of the uniform failures that attended all former efforts to propagate that species. In advance of the spawning season 30 of these fish, equally divided as to sex, were placed in a brood pond, and the remainder, which could not be distinguished as to sex, were left in their winter quarters. This mode of treatment proved successful, the yield of the two inclosures amounting to more than 34,000 fry and fingerling fish. The station also produced for distribution small numbers of rock bass and bream.

PONDFISH-CULTURAL STATIONS

This group includes seven main stations and four substations, whose work was concerned entirely with the so-called "pond" fishes. Their aggregate output compares favorably with the average of recent years, though it was considerably less than in 1925. Most of this decrease occurred in the production of largemouth black bass, the number of that species distributed being approximately 500,000 less than in the preceding year. The reduced yield is attributable partly to the prevalence of unfavorable weather during the spawning period and partly to inability to secure an adequate number of brood fish.

Cold Spring (Ga.) Station

[Charles A. Bullock, Superintendent]

A number of changes in the pond system at this point were made necessary by the recent construction of a new highway across a portion of the station grounds. The most important of these changes were the enlargement of several ponds and the construction of three new concrete overflows in other ponds.

It is customary at this station to drain all breeding ponds as soon as the young fish in them have been distributed (usually about August 1), and to allow them to remain dry until the 1st of February. The object of refilling the ponds at this time is to induce a larger growth of plankton than would be obtained otherwise. Because of hindrance by the road-building operations the work of refilling the ponds last season could not be attended to until March 1, at which time it is necessary to transfer the brood fish from their winter quarters to the ponds. The brood stock of largemouth black bass was augmented in advance of the spawning season by the purchase of 300 adults from the owner of a large lake near Milltown, Ga. The year's output of this species, to the propagation of which the work of the Cold Spring station is confined, has been exceeded only once in its history. This was in 1925, when approximately 125,000 more fish were distributed than in 1926.

Much difficulty has been experienced in procuring suitable fresh food in sufficient quantities to maintain the station brood fish. A shortage in the market supply of fresh-water mullet, the most satisfactory material heretofore obtainable, necessitated the substitution of the so-called "northern fresh-water mullet," on which some kind of preservative apparently had been used. It having been ascertained early in May that shrimp heads were a waste product in the shrimp industry, a trial shipment of that material was obtained. The bass ate it greedily, and in the future supplies of this material will be obtained at regular intervals if it is possible to do so.

Harris Ponds (Ga.) substation.—This auxiliary, consisting of a series of ponds situated about 4 miles from the main station, is devoted entirely to the production of bream and catfish. The ponds usually are drawn in early August and the fish in them transferred to the Cold Spring station ponds for distribution later in the season. A steady increase is noted in the annual output of these ponds, last year's excess over the output of the preceding year being about 30,000 fish.

Edenton (N. C.) Station

[W. S. Vincent, Superintendent]

Extensive improvements were made to the pond system during the year, the changes including the enlargement of one of the ponds to twice its former size. Though the station's production of pond fishes was smaller than last year's by approximately 45,000, this shortage was at least partly compensated by the larger size of the fish distributed. Owing to the adverse weather prevailing during February, the collection of brood yellow perch from commercial fishermen was delayed until March, and when finally acquired it was found that many of the 300 adults assembled had already spawned. Owing to this delay, only about 1,500,000 eggs were collected for the station. In addition to its output of black bass and yellow perch, the station produced and distributed small numbers of sunfish, crappie, warmouth bass, and catfish. A discussion of the shad and river herring work will be found on page 358 under the heading "Anadromous Fishes of the Atlantic Coast."

Louisville (Ky.) Station

[C. W. Burnham, Superintendent]

Though the spawning of the various pond fishes was greatly retarded by the cold, backward spring, natural conditions were generally favorable to nesting operations from May 1, when the first eggs were deposited, up to the close of the fiscal year. The output of fry from the brood largemouth black bass that had been held in the station ponds for several years was somewhat disappointing; but the results with smallmouth bass were quite satisfactory, the distributions of that species being slightly larger than those of any previous year in the history of the station. These results were attained with four breeding ponds, each of which was three-fourths acre in area, the available

brood stock of 515 fish being apportioned between them early in April. In preparing the smallmouth bass fry for shipment they were transferred direct from the ponds to the shipping containers, thus necessitating only a single handling. As the production of young bream was considerably greater than the demand for them, the surplus remaining after all listed applications had been filled was utilized in stocking suitable public waters within reach of the station. The year's distributions included small numbers of rock bass and channel catfish, the latter being obtained by collection from the Ohio River.

Lake-trout fry to the number of 14,750, the product of 15,000 eyed eggs forwarded early in March from the Duluth (Minn.) hatchery, were turned over to the Kentucky Game and Fish Commission for use in stocking a reservoir on the Dix River in Mercer County, Ky.

Mammoth Spring (Ark.) Station

[Dell Brown, Superintendent]

In its work with the pond fishes, this station had one of the most successful seasons in its history. In October, 1925, the pond devoted to rock-bass culture was drained, and more than fifteen thousand 2-inch rock bass were obtained for distribution to applicants in Arkansas and Louisiana. The stock of 232 adult smallmouth bass on hand began spawning on April 13, somewhat later than usual. The fry grew rapidly, however, and 121,000 were taken from the ponds before the close of the fiscal year and shipped to applicants. The year's production of largemouth bass, though not as large as the crop of young smallmouth bass, was fairly successful. The brood stock of 440 fish included many that were not fully matured, and such fish always produce smaller than the usual brood. Approximately 80,000 young largemouth bass had been distributed at the close of the year and a large number still remained in the pond. The output from this station also included a considerable number of bream and limited numbers of crappie and catfish.

The dry weather and consequent low-water stages in many of the streams in this region resulted in a material diminution of the supply of native game fishes in public waters.

Orangeburg (S. C.) Station

[G. W. N. Brown, Superintendent]

Owing to a combination of unfavorable natural conditions the output of black bass from this station was small as compared with the records of former years. The unusually cold weather predominating during February and early March unduly retarded the spawning season, and the prevalence of cold, backward weather late in March after spawning had begun caused many of the parent fish to desert their nests. It was observed in a number of instances that brood fish were abandoning their nests after the fry had hatched, leaving them prey to other fishes. Another contributing factor to the small output was the existing drought, the water supply at one time being so low that there was no current to carry the sediment out of the ponds.

The bream shown in the tables of output were carried over from the hatch of the preceding year and distributed to applicants as large-sized fingerlings. At the close of the year it was impossible to form any accurate estimate of the current season's hatch of bream. In addition to the output of bass and bream, the station produced and distributed small numbers of warmouth bass, crappie, and spotted catfish.

San Marcos (Tex.) Station

[O. N. Baldwin, Superintendent]

Of the six species of pond fishes propagated at this station the largemouth black bass is the most important. At the opening of the fiscal year 270 brood fish of that species were on hand in the station ponds, most of them being of rather small size. This stock was increased later to 480 by the addition of wild bass captured in local waters. In advance of the spawning season the fish were apportioned among the 14 breeding ponds devoted to the work, and on

March 15 the first fry of the season were observed. A large yield was assured by weather and water conditions, which were generally favorable throughout the season, and the output, amounting to 346,100, exceeded that of the previous year by 124,000. In accordance with past custom all of the fish were reared to the fingerling stage before shipment, the output including many thousands that ranged from 3 to 4 inches long when distributed. The station produced comparatively small numbers of rock bass, bream, and warmouth bass, while considerable numbers of such fishes were rescued from overflowed lands of the region and returned to their native waters.

With the view of establishing a source of supply for crappie for distribution to applicants, 275 brood fish of that species were collected from the Colorado River at Austin Dam during the winter and placed in tanks or ponds belonging to ranchmen in the vicinity of San Marcos. While none of the resulting fry had been distributed at the close of the year, several tests with seines indicated that good results might be expected later. In addition to the station output of pond fishes a considerable number of black bass was produced and distributed from the pond auxiliaries situated at Medina Lake and New Braunfels, Tex.

Tupelo (Miss.) Station

[C. R. Wiant, Superintendent]

At the opening of the spawning period, in the spring of 1926, the ponds at Tupelo station were carrying a brood stock of 458 largemouth black bass and all prospects seemed good for a large production of young fish of that species. This outlook was changed by the occurrence on March 24 of a sudden cold spell that covered two-thirds of the pond area with a one-fourth inch layer of ice. Under such conditions all of the fish abandoned their nests and the eggs deposited in them were lost. Another cold spell late in April not only resulted in the destruction of all eggs in the ponds at the time but it was followed by a period of storms and wind that roiled the pond water to such an extent as to cause very unfavorable nesting conditions. Taken as a whole, the weather during the bass spawning season was the most adverse ever encountered in the fish-cultural work at this point, but notwithstanding this fact the station's output of bass (aggregating 435,730, of which 73,230 were fingerling fish), was the third largest in its history.

A new method of procedure in the propagation of the bluegill bream was put into effect in advance of the spawning of that species. During June and July, after virtually all of the young black bass had been removed from the ponds, these ponds were stocked with adult bream collected from neighboring lakes, from 35 to 50 breeders being placed in each inclosure. The result was a decided success, the year's distributions of young bluegills totaling 200,150, more than double the record of any previous year. The year's work at this station also included the production of a comparatively small output of crappie and rock bass.

A considerable amount of improvement work was accomplished during the year, such work including the construction of one new pond 1½ acres in area.

Lakeland (Md.) Ponds Substation

[Supervised by Washington office of fish culture]

Early in the spring of 1925 four of the five ponds constituting this system were stocked with adult fish, one with largemouth black bass, one with smallmouth black bass, one with bream, and one with crappie. The prevalence of cold, unseasonable weather during the spawning period curtailed the results materially. Early in July, 3,405 fingerling fish seined from along the shores of the largemouth-bass pond, were distributed to applicants. During the first half of August large numbers of the fingerling fish in this pond were observed to come in close to the shore line, many in a dying condition, and all of them apparently distressed. An examination of the water showed it to be thick with some substance (afterward diagnosed as algæ of special species) that virtually covered the entire surface of the pond. About 2,000 of the fingerlings removed from the pond were placed in fresh water, where they revived immediately. When this pond was drained, later in the season, no live fingerling fish were found, and all of the adults were in very poor condition.

For some reason the smallmouth bass did not spawn to any appreciable extent, and only about twenty-five 4-inch fingerlings were found in their pond when it was drained. The yield of crappie amounted to 3,825 fingerling fish, Many of this species were lost through the development of algæ, which was just beginning to spread at the time the pond was drawn in early October.

CENTRAL STATION AND AQUARIUM, WASHINGTON, D. C.

[L. G. HARRON, Superintendent]

Earnest efforts were put forth during the year to maintain a creditable display of aquatic life in the aquarium, but it proved almost impossible at times owing to the almost constant use of chlorine in the city water supply. During the period from August 15 to January 1, when the water was almost free of chlorine, no difficulty was experienced in maintaining an attractive exhibit. During the last week of December, however, the reappearance of bacteria in the city supply again necessitated the use of chlorine in large quantities. There were on display at that time about 4,300 chinook-salmon fry and 18,500 rainbow-trout eggs just at the point of hatching. The eggs were at once turned over to the Maryland fish commission, but the fry succumbed to the effects of the chemical before any steps could be taken to dispose of them. Other species of fish eggs, including whitefish, cisco, and pike perch, were received later and successfully incubated. During the year 1,453 fish and aquatic animals, representing 33 species, were carried in the aquarium.

Part 2.—DISTRIBUTION OF FISH AND FISH EGGS

[E. C. Fearnow, Superintendent of Fish Distribution]

In distributing the year's output of 5,232,373,000 fish and fish eggs from the various stations of the bureau, trips were made to all parts of the United States; fish eggs were sent to the Governments of Canada, Argentina, Brazil, Colombia, Italy, Switzerland, and Japan, and one shipment of top minnows (*Gambusia affinis*) was forwarded to Santo Domingo. As usual, about 95 per cent of the year's output consisted of eggs and fry of the commercial fishes, and all of these except the comparatively few supplied to State fisheries authorities were planted in the waters from which the eggs were derived. The fishes included in this classification are the shad, glut herring, whitefish, cisco, the salmons, pike perch, yellow perch, carp, buffalo fish, cod, haddock, pollock, and winter flounder. The species mostly propagated for stocking interior waters are the brook, rainbow, blackspotted, and Loch Leven trouts, the largemouth black bass, smallmouth black bass, crappie, rock bass, bream, and catfish. While the number of fish of such species produced is comparatively small, representing only about 7 per cent of the entire output, it is this branch of the work that brings the bureau in close contact with the general public, making it relatively important, because public interest in the fisheries is an influence that can not be considered to be otherwise than beneficial.

The work connected with the distribution of fish is very heavy, in numerous instances necessitating long and laborious overtime duty. It is also quite hazardous, involving almost constant travel, and the salaries provided are much lower than those paid for similar work outside the Government service. Resignations submitted during the past year made it necessary to appoint three car messengers, two assistant messengers, and five car cooks. These changes, together with those involved in the transfer of two members of the distribution force to positions at fish-cultural stations of the bureau, constituted a turnover of 50 per cent in the car service personnel in the course of the fiscal year 1926.

The following table shows in summarized form the distribution of fish and fish eggs during the fiscal year to applicants in the United States and its territories. It also shows plants of fish made on the bureau's initiative in the public waters of the country in connection with the propagation of the commercial fishes and the salvage of fish from temporarily flooded lands. The output of the hatcheries that handle the commercial fishes is planted, so far as practicable, on the natural spawning grounds from which the eggs are derived, this course being essential for the maintenance of the fisheries, especially in regions where commercial fishing is prosecuted extensively and also in the case of the anadromous fishes. The activities of the commercial fishermen are coincident with the spawning period of the fish. Almost all salvaged fishes are returned to their native waters, only a very small percentage being used for filling applications.

Summary, by species, of distribution of fish, fiscal year 1926

State and species	Number
Alabama:	
Catfish	4,925
Largemouth black bass	258,300
Sunfish	51,290
Alaska: Sockeye salmon	55,297,000
Arizona:	
Catfish	52,700
Brook trout	40,000
Crappie	16,660
Largemouth black bass	2,517
Sunfish	3,400
Yellow perch	2,350
Arkansas:	
Catfish	1,457
Rainbow trout	6,375
Crappie	1,450
Largemouth black bass	82,790
Smallmouth black bass	112,225
Rock bass	11,600
Sunfish	31,700
Yellow perch	100
California: Chinook salmon	6,152,700
Colorado:	
Catfish	800
Steelhead salmon	24,150
Rainbow trout	179,570
Black-spotted trout	266,500
Loch Leven trout	174,000
Lake trout	101,000
Brook trout	2,781,500
Crappie	330
Largemouth black bass	7,010
Rock bass	800
Sunfish	1,800
Yellow perch	200
Connecticut:	
Rainbow trout	2,000
Brook trout	10,200
Pike perch	1,400,000
Yellow perch	65
Delaware:	
Crappie	600
Largemouth black bass	112
Sunfish	1,200
Yellow perch	65
District of Columbia:	
Crappie	125
Largemouth black bass	40
Pike perch	100,000
Florida: Largemouth black bass	2,000
Georgia:	
Catfish	3,200
Rainbow trout	35,800
Brook trout	42,000
Crappie	60
Largemouth black bass	219,857
Warmouth bass	60
Sunfish	123,030
Yellow perch	116
Idaho:	
Chinook salmon	12,724,000
Steelhead salmon	79,000
Rainbow trout	127,000
Black-spotted trout	164,900
Loch Leven trout	8,000
Brook trout	4,160
Illinois:	
Catfish	3,800
Crappie	10,575
Largemouth black bass	7,485
Sunfish	12,450
Yellow perch	200
Miscellaneous fishes	6,087,809
Indiana:	
Catfish	9,150
Brook trout	20,000
Crappie	6,640
Largemouth black bass	10,370
Smallmouth black bass	90,100
Sunfish	21,375
Yellow perch	3,000
Iowa:	
Catfish	13,030,909
Buffalo fish	9,055,445
Carp	15,599,600
Rainbow trout	30,050
Loch Leven trout	2,000
Brook trout	11,000
Pike and pickerel	65,950
Crappie	8,678,855
Largemouth black bass	34,599
Sunfish	8,542,995
Yellow perch	130,755
Sheepshead	278
White bass	835
Drum	4,840
Miscellaneous fishes	1,092,536
Kansas:	
Crappie	1,100
Largemouth black bass	4,700
Sunfish	800
Yellow perch	384
Kentucky:	
Catfish	1,000
Lake trout	29,000
Largemouth black bass	2,253
Smallmouth black bass	597,000
Rock bass	2,250
Sunfish	15,700
Louisiana:	
Catfish	400
Buffalo fish	105,315,000
Rock bass	4,300
Sunfish	20,100
Maine:	
Humpback salmon	998,900
Landlocked salmon	554,155
Brook trout	1,119,880
Crappie	600
Largemouth black bass	100
Smallmouth black bass	2,455
Flatfish	1,487,438,000
Maryland:	
Rainbow trout	23,950
Loch Leven trout	1,500
Brook trout	7,200
Crappie	1,500
Largemouth black bass	1,393
Smallmouth black bass	60
Sunfish	1,000
Yellow perch	50
Massachusetts:	
Steelhead salmon	1,500
Landlocked salmon	125,000
Rainbow trout	1,080
Brook trout	19,263
Mackerel	2,067,000
Smallmouth black bass	1,660
Pike perch	1,155,000
Cod	558,662,000
Haddock	31,895,000
Pollock	428,778,000
Flatfish	828,727,000
Michigan:	
Catfish	1,400,000
Whitefish	44,800,000
Steelhead salmon	39,500
Rainbow trout	94,500
Lake trout	25,712,000
Brook trout	665,501
Crappie	3,000
Largemouth black bass	600
Smallmouth black bass	148,350
Sunfish	3,200
Pike perch	2,475,000
Minnesota:	
Catfish	1,226,150
Buffalo fish	139,870
Carp	2,795,915
Rainbow trout	68,100
Loch Leven trout	48,320
Lake trout	1,941,500

Summary, by species, of distribution of fish, fiscal year 1926—Continued

State and species	Number
Minnesota—Continued.	
Brook trout	139,100
Pike and pickerel	154,630
Crappie	9,741,215
Largemouth black bass	119,775
Sunfish	6,415,703
Yellow perch	2,248,250
White bass	13,105
Fresh water drum	97,175
Miscellaneous fishes	989,850
Mississippi:	
Crappie	155
Largemouth black bass	346,305
Warmouth bass	1,000
Sunfish	180,950
Missouri:	
Catfish	12,550
Rainbow trout	141,020
Crappie	7,564
Largemouth black bass	15,600
Rock bass	1,500
Sunfish	25,913
Yellow perch	207
Montana:	
Rainbow trout	1,718,600
Black-spotted trout	1,514,724
Loch Leven trout	577,575
Brook trout	528,430
Grayling	4,823,800
Nebraska:	
Rainbow trout	31,250
Loch Leven trout	32,400
Brook trout	152,900
Crappie	500
Largemouth black bass	595
Sunfish	1,000
Yellow perch	375
Nevada:	
Rainbow trout	46,200
Black-spotted trout	8,400
Brook trout	70,350
New Hampshire:	
Landlocked salmon	500
Rainbow trout	61,000
Loch Leven trout	17,800
Brook trout	906,966
Pike perch	175,000
New Jersey:	
Catfish	90
Rainbow trout	500
Brook trout	1,800
Crappie	3,180
Largemouth black bass	7,945
Sunfish	4,850
New Mexico:	
Catfish	2,200
Steelhead salmon	14,500
Black-spotted trout	40,000
Brook trout	8,750
Crappie	490
Largemouth black bass	2,195
Rock bass	200
Sunfish	1,700
New York:	
Whitefish	40,400,000
Lake herring	84,700,000
Rainbow trout	104,000
Loch Leven trout	68,540
Lake trout	1,671,500
Brook trout	466,560
Crappie	5,750
Largemouth black bass	2,155
Smallmouth black bass	465
Sunfish	3,001
Pike perch	3,300,000
Yellow perch	280,540
Flatfish	18,069,000
North Carolina:	
Catfish	1,700
Glut herring	30,000,000
Rainbow trout	87,780
Brook trout	202,000

State and species	Number
North Carolina—Continued.	
Crappie	4,742
Largemouth black bass	107,732
Rock bass	4,400
Warmouth bass	650
Sunfish	38,535
Yellow perch	1,500,040
North Dakota:	
Catfish	2,550
Crappie	4,625
Largemouth black bass	1,245
Sunfish	7,500
Yellow perch	4,125
Ohio:	
Catfish	3,450
Carp	54,500,000
Whitefish	107,924,000
Rainbow trout	20,500
Brook trout	60,000
Crappie	5,200
Largemouth black bass	12,280
Smallmouth black bass	64,000
Sunfish	10,145
Pike perch	135,320,000
Yellow perch	7,592,050
Oklahoma:	
Catfish	4,600
Rainbow trout	10,280
Loch Leven trout	42,000
Crappie	4,140
Largemouth black bass	27,930
Rock bass	290
Sunfish	5,430
Yellow perch	225
Oregon:	
Chinook salmon	9,439,000
Silver salmon	2,559,800
Steelhead salmon	1,713,475
Rainbow trout	10,000
Brook trout	153,300
Silver trout	65,500
Pennsylvania:	
Catfish	16,520
Rainbow trout	201,450
Loch Leven trout	112,200
Brook trout	1,134,750
Crappie	21,107
Largemouth black bass	25,655
Sunfish	46,225
Yellow perch	9,435
South Carolina:	
Catfish	35
Rainbow trout	31,000
Brook trout	45,400
Crappie	524
Largemouth black bass	46,475
Warmouth bass	1,100
Sunfish	27,670
South Dakota:	
Rainbow trout	32,200
Loch Leven trout	163,100
Brook trout	1,146,350
Tennessee:	
Catfish	8,800
Rainbow trout	41,900
Brook trout	51,350
Crappie	8,000
Largemouth black bass	83,285
Sunfish	41,617
Yellow perch	1,694
Texas:	
Catfish	5,602
Steelhead trout	5,500
Rainbow trout	9,220
Crappie	28
Largemouth black bass	427,266
Smallmouth black bass	3,000
Rock bass	5,315
Warmouth bass	1,769
Sunfish	66,533

Summary, by species, of distribution of fish, fiscal year 1926—Continued

State and species	Number
Utah:	
Catfish	24,200
Rainbow trout	530,775
Black-spotted trout	28,800
Brook trout	478,600
Vermont:	
Steelhead salmon	103,000
Landlocked salmon	9,522
Loch Leven trout	40,000
Rainbow trout	17,000
Lake trout	56,800
Brook trout	1,018,432
Smallmouth black bass	39,000
Pike perch	5,900,000
Yellow perch	17,150,000
Virginia:	
Rainbow trout	173,468
Brook trout	251,750
Crappie	2,403
Largemouth black bass	247,602
Smallmouth black bass	32,600
Rock bass	6,410
Sunfish	15,465
Washington:	
Chinook salmon	38,577,265
Silver salmon	7,193,050
Sockeye salmon	11,827,980
Humpback salmon	844,600
Steelhead salmon	2,443,250
Rainbow trout	37,600
Black-spotted trout	6,300
Brook trout	180,000
West Virginia:	
Catfish	8,850
Rainbow trout	495,836
West Virginia—Continued.	
Loch Leven trout	163,500
Brook trout	1,055,409
Crappie	400
Largemouth black bass	86,907
Rock bass	6,400
Sunfish	1,300
Pike perch	600,000
Yellow perch	1,625
Wisconsin:	
Catfish	11,672,325
Buffalo fish	1,153,600
Carp	15,257,000
Rainbow trout	169,300
Loch Leven trout	135,860
Lake trout	977,500
Brook trout	669,950
Pike and pickerel	84,690
Crappie	4,525,315
Largemouth black bass	85,615
Smallmouth black bass	5,000
Rock bass	200
Sunfish	11,039,445
Pike perch	13,842,200
Yellow perch	368,971
White bass	25,938
Drum	21,425
Miscellaneous fishes	5,125,933
Wyoming:	
Catfish	100
Rainbow trout	154,100
Black-spotted trout	2,847,000
Loch Leven trout	384,800
Brook trout	962,102
Black bass	210

METHOD OF DISTRIBUTION

In connection with its work of supplying fish on the 12,000 to 15,000 applications received every year, the bureau aims to so apportion the output of its hatcheries as to obtain the maximum results, giving special consideration to waters in which the fish planted will have an opportunity to mature and reproduce. In pursuance of this plan many difficulties are encountered, not the least of them being the frequent insistence of an applicant to obtain some favorite species of fish regardless of whether or not the waters he desires to stock are suitable therefor. The bureau, of course, refuses to furnish fish for waters to which they are not adapted, but it is often difficult to convince an applicant of the wisdom of this policy.

Requests for fish of the warm-water species, especially the largemouth and smallmouth black bass, have increased to such an extent within recent years that the present outlook for satisfying the demand does not appear hopeful. In the past the bureau has relied largely on the collecting fields along the Mississippi River for its stock of largemouth black bass for supplying applicants residing in States where no Federal bass hatcheries are operated, but within recent years such collections in the rescue fields have been comparatively small, sometimes not exceeding 500,000 in a season. As a large percentage of the bass collected must be returned to their native waters for the maintenance of the supply, it can readily be understood that this source is not dependable and that great necessity exists for the establishment of additional sources of supply for black bass, especially in the east and the midwest, if the demands for this

fish are to be met. Within recent years the output of smallmouth bass at hatcheries in the east has been almost negligible.

Very little difficulty is experienced in producing the various species of trout in sufficient numbers to meet requirements, owing to the fact that they can be hatched artificially and fed on beef liver or other food until they attain fingerling size; but this is different with the basses. These fish prefer live food; they must be allowed to reproduce under more or less natural conditions in specially prepared ponds, and the output of a season depends largely upon climatic conditions prevailing during the spawning season.

COST OF DISTRIBUTION

In recent years the office of distribution has economized to the utmost, and if the constantly increasing demands for fish are to be satisfied, additional funds must be provided. Before the World War as much as $80,000 was expended in distributing the bureau's annual output of fish and fish eggs. That the cost of distribution can not be reduced below the amount at present allowed is evidenced by the heavy shipments that are now being carried to a trip. With the view of accomplishing as much work as possible on the allotment provided, messenger shipments in baggage cars have been made exceedingly heavy. In 1914, at a time when the cost of everything entering into the work was comparatively low, the year's output of 4,047,643,417 fish and fish eggs was distributed at a cost of $68,399.93. The past fiscal year's output of 5,232,373,000 fish and eggs—more than 1,000,000,000 in excess of the output in 1914—was distributed for $58,000, approximately $10,000 less than the amount expended in 1914.

In 1926 the bureau honored 13,118 applications for fish and made deliveries on 12,000 applications. In making the distributions the cars traveled 84,600 miles and the detached messengers 403,000 miles.

In distributing the fish produced at the bureau's stations the principal part of the cost involved is in the shipment of the fingerlings intended for stocking interior waters. The expense of distributing the output of stations handling marine and anadromous species and the fishes of the Great Lakes region is comparatively small. The records show that in 1914 the output of the most expensive fishes to distribute—landlocked salmon, rainbow trout, brook trout, largemouth black bass, and smallmouth black bass—aggregated only a little more than 24,000,000, while in 1926 nearly 40,000,000 of such fishes were shipped. Furthermore, the trout distributed in 1926 were larger in the main than those distributed in any previous year in the bureau's history.

The cost of distributing one thousand 4-inch fish is at least five times greater than the amount involved in distributing an equal number of fry; but, on the other hand, the stocking value of the larger size is estimated to be ten times greater than that of the same number of fry. In view of this fact it is advisable to rear as many of the fish as possible to the stage where they will be able to care for themselves in their new environment, even though it costs more to distribute them. In fact, it would be good policy to limit the output of all cooperative stations to the number of fish that can be reared to a length of 3 or 4 inches before disposing of them.

While recent improvements to the distribution cars and their equipment have almost doubled their carrying capacity, it has not been possible to reduce the cost of maintenance or the cost of repairs. Out of every $5 expended in the distribution of fish by the cars, $2 must be applied to maintenance and repairs. This leaves only about 60 per cent of the allotment for travel, subsistence, and incidentals. It is out of this 60 per cent that any savings must be effected.

The cooperative stations were not prepared to receive fish at the time when transfers could have been made most economically, hence the fish had to be carried at the rate of 400 or 500 to the can. Had it been possible to ship them in March or April, 1,500 fish could have been carried in a can.

ALLOTMENT OF FISH TO APPLICANTS

In alloting fish to applicants, the bureau considers (1) the available stock of the species assigned, (2) the size of the fish at the time the distribution is made, (3) the number of applications to be filled, (4) the extent of the water area to be stocked, and (5) the distance involved in making the delivery. It endeavors in every case to furnish a sufficient number of young fish for the establishment of a brood stock, and the recipient is expected to see that the fish are furnished adequate protection until they have had time to mature and stock the waters through natural reproduction. While it is recognized that large bodies of water should receive more fish than smaller ones, it does not seem wise to honor applications for large water areas to the exclusion of smaller though perhaps not less important waters. It is the policy to apportion the output of the bureau's hatcheries in such a manner as will permit the filling of all applications listed. Requests for fish frequently are received from individuals living in sections remote from a fish-cultural station and in a region whose waters already abound with desirable fishes. In a case of that kind the bureau does not consider it proper to incur the expense of sending a small number of hatchery-reared fish to an applicant and he is notified to that effect.

TIME OF DELIVERY

It is the policy of the bureau to fill applications in the order of their receipt and to deliver the assigned fish as soon as possible thereafter. Certain phases of the distribution work, however, should be thoroughly understood in advance by prospective applicants.

The high cost of shipping fish compels the bureau to exercise rigid economy in planning the work of its cars and messengers. The delivery of fish to an applicant remotely situated can not be made until a sufficient number of applications have been received from that section of the country to warrant the expense of making a messenger shipment. The bureau can not carry a stock of fish for delivery on demand, and when the supply of one year is exhausted all unsupplied applicants must wait until the succeeding year's output is available. Trout shipments from the bureau's eastern stations begin in March, and all applications from the Eastern States received after the 1st of March are carried on file for attention the

following year. Trout are distributed from stations in the Rocky Mountain region from May to October, and in order to insure early delivery, applications from that section should be submitted prior to May 1. Applications for such warm-water fishes as bass, sunfish, and crappie should be submitted prior to May 1, as such species are shipped between May and December.

Fish are shipped in railroad cars especially designed for the purpose or in baggage cars accompanied by messenger, and delivery is made at the applicant's railroad station free of cost to him. On the receipt of an application for fish the applicant is immediately notified as to the species assigned thereon and the approximate time of delivery. Full directions as to the manner of receiving and caring for the fish also are furnished him. Shortly before shipment is made a second notice is sent, specifying the exact time when the consignment will arrive at the applicant's railroad station. If for any reason the delivery must be postponed, the applicant is duly notified.

DISTRIBUTION CARS

Of the five specially equipped cars operated by the bureau in the transportation of live fish, three are of steel construction and two of wood. Owing to the increased carrying capacity of the steel cars, which is approximately two-thirds greater than that of the wooden ones, it has frequently been urged on the ground of economy and efficiency, that the wooden cars be replaced with cars of steel construction. The railroad companies object to hauling wooden cars in their best trains, and as a matter of fact it would be dangerous to place a wooden car between two steel coaches even though it were equipped with the electrical connections required on cars carried in modern trains. Furthermore, a car of wood construction is not allowed to pass through the tube under the Hudson River. In view of the foregoing, the saving in transportation and maintenance costs involved in the substitution of all-steel cars is obvious. In the interest of economy and efficiency, it may be stated, to insure the successful transportation of live fish they must be moved expeditiously. Any considerable delay en route not only disarranges the whole itinerary of a trip and necessitates the expense of telegraphing to a hundred or more applicants, but in many instances it results in the loss of fish.

CAR NO. 3

[E. R. Widmyer, Captain]

At the beginning of the fiscal year 1926 the Fearnow pails on this car were overhauled, cleaned, and restenciled; the aerating equipment of the car was repaired and its pumps and machinery placed in good condition.

The distribution of warm-water fishes from the La Crosse (Wis.) station was taken up on August 13, at which time a carload shipment of fish was made to Milwaukee, Wis. During August and the three succeeding months the car made 11 trips from Mississippi River stations, carrying from 156 to 201 pails of fish to a trip. In addition to this travel a number of messenger shipments were made to points in Wisconsin, Minnesota, Iowa, Illinois, and Michigan. In the course of the season the car and its crew carried from the Mississippi River stations and delivered to applicants a total of 227,155 fingerling fish, of which 56,960 were black bass, 64,835 crappie, 46,745 bream, 25,775 yellow perch, and 32,740 catfish.

In late November, after the close of the distribution season in the rescue field, the car was transferred to Milwaukee, Wis., to undergo annual repairs, and its crew was detailed to fish-cultural stations of the bureau for the winter months. The car was held in the coach yards of the Chicago, Milwaukee & St. Paul Railway Co. from December 1 until early in January, when it was sent to the repair shops. On the completion of the repairs the car was returned to the coach yards and held until April 26, when it proceeded to La Crosse, Wis., at which point its equipment was overhauled preparatory to taking up the spring distributions. The car left La Crosse on May 23 with 59,900 brook trout, 22,500 Loch Leven trout, and 10,000 rainbow trout, all fingerlings, for delivery to applicants in Wisconsin and Minnesota. After completing this trip it proceeded to the Duluth (Minn.) station to distribute the season's output of lake trout and whitefish, and during the remaining days in May and early June the crew planted and delivered 16,290,000 pike-perch fry, 1,400,000 whitefish fry, 8,812,000 lake-trout fry, and 129,600 fingerling brook trout. On the completion of the Duluth distributions the car proceeded to the Manchester (Iowa) station, arriving there June 11. After moving 105,700 fingerling brook, rainbow, and Loch Leven trout from this station to Minocqua, Wis., the car returned to La Crosse and remained there until June 28, when it again arrived at Manchester and took on a load of fingerling trout for delivery to Wisconsin applicants. While stationed at La Crosse messenger shipments of fingerling trout aggregating 87,100 were delivered by members of the crew to applicants in Minnesota and Wisconsin.

During the fiscal year 1926 the car traveled 14,982 miles and carried 227,315 fingerling pond fishes, 16,290,000 pike-perch fry, 1,400,000 whitefish fry, 8,812,000 lake-trout fry, 307,800 fingerling brook trout, 55,000 fingerling rainbow trout, and 33,600 fingerling Loch Leven trout, a total of 27,125,715 fish.

CAR NO. 4

[F. W. A. Engelhardt, Acting captain]

Car No. 4 was at Portland, Me., at the beginning of the fiscal year, having just completed the distribution of trout from the Craig Brook (Me.) hatchery. It left there on July 3 for Nashua, N. H., at which point it remained until August 14 while its crew made messenger shipments of trout to various points in New Hampshire, Connecticut, and Massachusetts. On August 15 the car proceeded to Washington, D. C., with a consignment of brook trout for stocking cooperative nursery projects at Myersdale and Uniontown, Pa., the deliveries being made by messenger from Washington. One member of the crew was detailed to distribute trout from the Watertown (N. Y.) substation, and the remainder of the force was assigned to the distribution of fish from the Lakeland (Md.) ponds. The car was ordered to Dubuque, Iowa, on October 24 to assist in the distribution work from the Mississippi River collecting stations. It made carload shipments of fish from that field to Nashua, Iowa; Cookeville, Tenn.; Harrisburg, Pa; and Washington, D. C., arriving at the last-named destination on November 30. The car was then sent to the shops of the Pennsylvania Railroad Co. at Wilmington, Del., for annual repairs, and the members of its crew were detailed to the Washington office for duty during the winter.

On the last day of March Car No. 4 left Washington to take up the distribution of trout from the White Sulphur Springs (W. Va.) station. Messenger shipments were made to points in Virginia and West Virginia, and carload shipments of trout were forwarded to Elkins, W. Va. (two trips), Altoona, Philipsburg, Uniontown, Windber, and Philadelphia, Pa. From Philadelphia the car went to Nashua, N. H., and obtained a carload of trout for distribution en route to Bucksport, Me., to take up the trout and salmon distribution work from the Craig Brook (Me.) hatchery. Carload shipments were made from Bucksport to Calais (two trips), Kineo, Mattawamkeag, Blanchard (two trips), Dover, Foxcroft, Houlton, and Waterville, Me. The car then returned to the Nashua station, arriving there June 26. Messenger shipments were made from Nashua.

In the course of the fiscal year the car made 27 trips, traveled 15,030 miles, and delivered 3,700 pails of fish, supplying 1,119 applicants.

Species and size of fish delivered by car No. 4

Species	Fry	Fingerlings No. 1	Fingerlings No. 2	Fingerlings No. 3	Fingerlings No. 4	Yearlings	Adults
Catfish				5,750	1,900	900	750
Atlantic salmon	776,000	125,637					
Landlocked salmon	136,000	103,000		151			
Rainbow trout		112,300	82,900				
Loch Leven trout		82,300		400	400	1,340	
Brook trout	481,600	1,172,500	12,600			2,250	
Grayling							5
Crappie			5,850	6,975	2,600		
Largemouth black bass				2,510	2,830	1,147	255
Smallmouth black bass					425		
Sunfish			3,240	410		750	490
Yellow perch				4,800			
Total	1,393,600	1,595,737	104,590	20,996	8,155	6,387	1,500

CAR NO. 7

[E. M. LAMON, Captain]

Car No. 7 arrived at Bozeman, Mont., on July 1 and immediately undertook the distribution of trout. Messenger trips were made to nearby points, and carload shipments of fish were forwarded to Glacier Park and Lewistown, Mont., and Casper, Wyo. The car and its crew were then detailed to work under the direction of the Montana Fish and Game Commission, and from July 23 to the end of August, 12 carload shipments aggregating 2,405,000 black-spotted and rainbow trout were transported from State hatcheries at Emigrant, Anaconda, Missoula, Hamilton, and Great Falls, Mont., and distributed at various points in that State. The car resumed its work from the Bozeman station on September 1, making trips to Spokane, Wash.; Lander, Wyo.; and Dubuque, Iowa. In the course of the season, 302,500 brook trout, 416,000 rainbow trout, 186,500 black-spotted trout, 53,000 Loch Leven trout, and 6,000 landlocked salmon were distributed from Bozeman. En route from Bozeman to Dubuque applicants in Wyoming and Wisconsin were supplied, and 24 adult grayling and 19 black-spotted trout were delivered for the aquariums at Lincoln Park, Chicago, Ill., and Central Station, Washington, D. C. The car reached Dubuque on September 28, and after completing its deliveries of fish it was placed in the Chicago, Milwaukee & St. Paul Railway Co. shops for minor repairs.

The distribution work from the upper Mississippi River rescue stations was taken up on October 5. In the course of trips made to Union City and Philadelphia, Pa.; Tuscaloosa, Ala.; Knoxville, Tenn.; Fort Wayne, Ind.; and St. Louis, Mo., 109,000 fingerling pond fishes were distributed by the car and its messengers in the States of Pennsylvania, Alabama, Tennessee, Indiana, Missouri, New Jersey, Maryland, and Ohio. In connection with the trip to Philadelphia the car took on 20,000 fingerling brook trout from a commercial hatchery at Mauch Chunk, Pa., and delivered them to the Northville (Mich.) station of the bureau. On the completion of the distributions in the rescue field early in December the car was placed in the railway shops at Dubuque for general repairs and its crew was detailed for duty during the winter at various fish-cultural stations of the bureau.

On May 5 the car took on at the Manchester (Iowa) station a load of 36,400 rainbow trout, 65,000 brook trout, and 30,500 Loch Leven trout for delivery at Madison, Wis. From Madison it returned to La Crosse, and between May 9 and May 29 it received from the La Crosse station and distributed to applicants in Wisconsin and Minnesota 115,000 rainbow trout, 402,000 brook trout, and 85,000 Loch Leven trout. On the completion of this work it proceeded to the Northville (Mich.) station, and on June 12 transported a load of brook trout from that point to Hillman, Mich., for the Turtle Lake Club. Returning to Northville on the completion of this trip, a number of messenger shipments of trout and smallmouth black bass were made by its crew, supplying applicants in Michigan, Indiana, and Ohio. The numbers and species of fish distributed during the year are shown in the following table:

Species	Fry	Fingerlings	Yearlings	Adults
Catfish		7,000	500	80
Landlocked salmon		6,000		
Rainbow trout		735,600		
Black-spotted trout		2,350,500		19
Loch Leven trout		124,500		
Brook trout		778,200	7,240	
Grayling				24
Crappie		25,075	926	
Largemouth black bass		20,800	630	28
Smallmouth black bass	227,500			
Sunfish		18,250	1,960	195
Yellow perch		4,860		12
Total	227,500	4,070,785	11,256	358

During the year the car made 34 trips and traveled 23,944 miles, while messengers operating from the car made 100 trips and traveled 28,387 miles.

CAR NO. 8

[E. K. BURNHAM, Captain]

In the course of the year car No. 8 distributed fish from the upper Mississippi River rescue field and from the Neosho (Mo.), Langdon (Kans.), and Leadville (Colo.) stations. It carried 13 carload lots of fish, traveled 7,041 miles over eight railroads, sent out 50 side trips, and delivered 777,522 fish in 10 States. The following table shows the species and numbers of fish handled:

Species	Fingerlings	Yearlings	Adults
Catfish	6,500		
Steelhead salmon	30,000		
Rainbow trout	91,320		
Black-spotted trout	181,000		
Brook trout	416,750		
Crappie	2,465	3,430	
Largemouth black bass	37,960	25	
Rock bass	1,550		
Sunfish	5,000	330	408
Yellow perch	784		
Total	773,329	3,785	408

In addition to the 50 side trips made from the car, its messengers made 32 trips with fish from the hatcheries, distributing an aggregate of 576,395 fingerling catfish, steelhead salmon, rainbow, black-spotted, and brook trout, crappie, largemouth black bass, sunfish, and yellow perch, at a total cost of $1,861.40.

The crew of the car made all needed minor repairs to its interior during the year and maintained all of its railroad appurtenances in accordance with existing traffic regulations, such work being accomplished at a moderate cost. One of the most valuable changes effected by the crew was the arrangement of the piping in the boiler room, so that water from the boiler may be drawn by the injector through pipes coming from the pressure tanks on each side of the car and also from the tanks above the kitchen. These three sources of supply assure enough water to operate the boiler at all times.

A very simple but at the same time a most satisfactory improvement was made by the railroad company. It consisted in the installation of hardwood shims under the equalizing springs of the car, which allow the car to balance perfectly and ride much more smoothly than it has in the past.

CAR NO. 9

[H. F. JOHNSTON, Captain]

Early in July, 1925, this car was stationed at Washington, D. C., while the members of its force were engaged in making messengers shipments with black bass from the Lakeland (Md.) ponds to applicants in Maryland, Virginia, and New Jersey. On July 24 the car proceeded to the White Sulphur Springs (W. Va.) station and obtained a carload of fingerling rainbow trout for stocking waters in the vicinity of Cass, W. Va. Upon arrival at Cass the entire load of fish was transferred to a logging railroad and transported 35 miles into the mountains, to be planted in streams near the headwaters of the Elk River. From Cass the car returned to White Sulphur Springs and distributed another load of trout to applicants in the vicinity of Williamsport, Pa.

Shortly after the middle of August this car was assigned to the work of distributing black bass and miscellaneous fishes from the various rescue stations along the Mississippi River. As a result of its activities in that field, which extended into the last week in November, 56,662 black bass, 10,599 yellow perch, 50,205 bream, 29,200 catfish, and 48,275 crappie were distributed to applicants in Wisconsin, Tennessee, Ohio, Indiana, Pennsylvania, New Jersey, and New York. The car also made a trip from Homer, Minn., to Globe, Ariz., with a load of fingerling black bass, crappie, catfish, yellow perch, and sunfish for deposit in the Roosevelt Reservoir at that point. On November 24 the car returned to Washington, D. C., and the members of its crew were detailed for winter duty at fish-cultural stations of the bureau. Annual repairs were made in December at the Pennsylvania Railroad Co. shops at Wilmington, Del., and after their completion the car was utilized as living quarters for such members of the distribution force as were detailed to the Washington office of the bureau.

With the view of taking up the spring distribution of trout from the Erwin (Tenn.) station, the car left Washington on April 1, proceeding via Government Siding, Va., where it took on a load of fingerling brook trout and distributed the fish to applicants en route to Erwin. In order that the car might be available at an early date for distributing the large surplus of trout that was being carried at the White Sulphur Springs (W. Va.) station, thus relieving the congested conditions at that hatchery, the Erwin distribution work was rushed and the car moved the entire station output of 397,000 brook and rainbow trout and 17,000 miscellaneous pond fishes in three trips, supplying applicants in North Carolina, South Carolina, Georgia, and Tennessee. Between April 28 and June 5 the car distributed from the White Sulphur Springs station 880,400 fingerling brook, rainbow, and Loch Leven trout, making deliveries to 475 applicants in Virginia, West Virginia, and Pennsylvania. During the remainder of the fiscal year the services of this car were loaned to the Maryland Conservation Commission.

In the course of the year the car made 26 trips, traveled 23,497 miles, carried 1,778,806 trout and pond fishes, and supplied 1,581 individual applicants in 13 States. The total cost of its operations was $7,502. Its distributions are summarized in the following table:

Species	Fingerlings No. 1	Fingerlings No. 2	Fingerlings No. 3	Fingerlings No. 4	Adults
Catfish		8,700	17,800	1,700	
Rainbow trout		275,900	191,650		
Loch Leven trout		35,500	4,800		
Brook trout	67,000	1,003,400			
Crappie		8,200	39,745		
Largemouth black bass		8,000	16,485	32,188	674
Rock bass	3,000			400	
Sunfish	46,000	2,800		1,205	3,200
Yellow perch		1,875	8,560		24
Total	116,000	1,344,375	279,040	35,493	3,898